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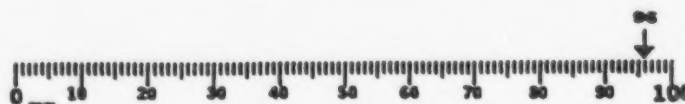
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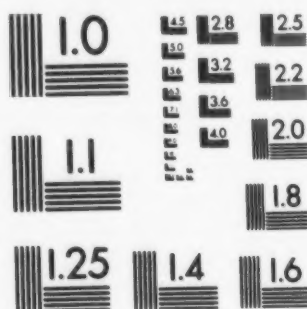
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National Bureau of Standards
Standard Reference Material 1010a
(ANSI and ISO Test Chart No. 2)



PM-1 3 1/2" x 4" PHOTOGRAPHIC MICROCOPY TARGET
NBS 1010a ANSI/ISO #2 EQUIVALENT



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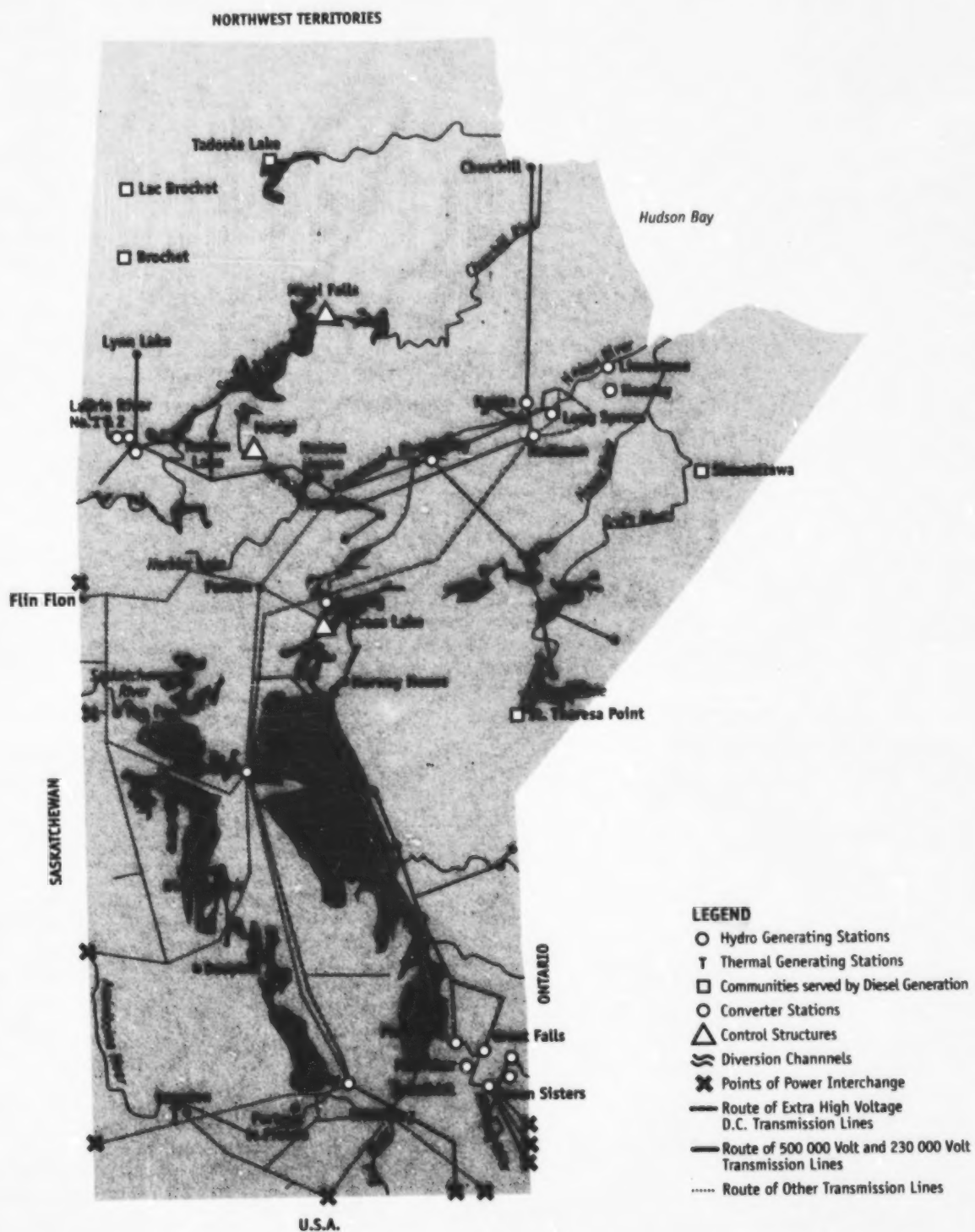
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Sustainable Development Report

4th EDITION 1998



Major components of the Manitoba Hydro system



Message from The President and CEO



I am pleased to introduce a new format for Manitoba Hydro's public reports about our sustainable development performance.

We published our first Sustainable Development Report in 1993. It contained stories, graphs and other data about our environmental and economic activities. It was accompanied by a pledge to continue producing Sustainable Development Reports on a biannual basis. Volumes 2 and 3 of our Sustainable Development Reports were published in 1995 and 1997.

This report marks a new watershed in our on-going commitment to public accountability. It is the first of our annual reports. For the first time it also compares Manitoba Hydro's performance with the best, average and worst performances of electricity utilities across Canada. These national indicators are derived from the Canadian Electricity Association's report on its Environmental Commitment and Responsibility Program. As part of this program, begun two years ago, utility members across Canada are now reporting their performance through a series of environmental indicators. As expected Manitoba Hydro has excelled in some areas; in others we have challenges and opportunities to improve.

Along with these data, we present stories which highlighted our year. These include the launch of a program to implement an environmental management system which conforms to international standards; the construction of a 4-kilometre weir to improve aquatic conditions on the lower Churchill River; and the initiation of a program encouraging young northern Aboriginal adults to develop careers in Manitoba Hydro's generating stations. These and other stories in this report provide insights into our many sustainable development activities.

I trust you will find this, our first annual Sustainable Development Report, both informative and interesting.

R.B. Brennan, F.C.A.
President and CEO



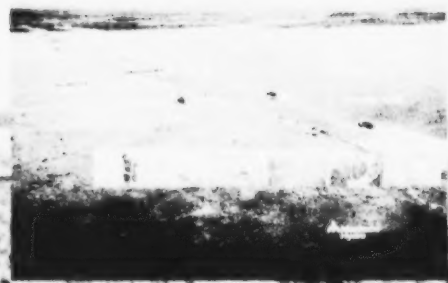
Highlights

*Above photo:
Members of the Aboriginal
Pre-placement Training
Program performing
maintenance in the Long
Spruce Generating
Station turbine pit*

- Manitoba Hydro, like other electrical utilities across Canada, has begun to develop and implement an environmental management system that will meet international standards. Please see page 4.
- Manitoba Hydro is committed to reducing the production of greenhouse gases in line with Canada's pledge to the international community by 6% below 1990 levels by 2008-2012. Page 6. And Manitoba's natural heritage of strong flowing rivers provides the opportunity for our province to contribute much more to global efforts to deal with climate change issues. Please see page 7.
- A 4-kilometer weir has been constructed across the lower Churchill River to increase water levels, improving habitat for fish and recreational opportunities for local residents. Please see page 15.
- Manitoba Hydro is working with local communities to collect ecological information in areas where hydroelectric projects could be developed in the future. Please see page 16.
- Customers have saved over \$100 million through Power Smart initiatives since the energy conservation program began about a decade ago. Please see page 22.
- Once again Manitoba Hydro has achieved record sales and revenues while continuing to provide Manitoba customers with some of the lowest electricity rates in the industrial world. Please see page 28.
- A new program is providing an opportunity for young Aboriginal adults to gain experience in three technical trades, with the hope this experience will encourage them to pursue a career with our company. Please see page 32.
- Throughout this report environmental indicators compare Manitoba Hydro's performance with the performance of other Canadian electricity utilities. The protocols for calculating these indicators are contained on pages 36 and 37.

This report covers events and data for 1998. In a number of instances, Editor's Updates provide information about relevant activities occurring prior to publication.

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INDICATORS OF PROGRESS

MANAGEMENT SYSTEM TO MEET INTERNATIONAL STANDARDS

Manitoba Hydro, like other electrical utilities across Canada, has begun to develop and implement an environmental management system that will meet international standards.

While Manitoba Hydro has many environmental activities, the initiative to encompass all corporate operations within an environmental management system was prompted by the Canadian Electricity Association's Environmental Commitment and Responsibility Program. Under this program every member utility must implement an environmental management system consistent with ISO (International Organization for Standardization) criteria.

First in line to develop environmental management systems are the Power Supply business unit, which plans and operates generating and converter stations, and other corporate functions necessary to support Power Supply's environmental management system. They will have environmental management systems functioning by the end of 1999. The remaining Manitoba Hydro business units, including Transmission and Distribution operations, will be on board by 2002.

ISO's standard for environmental management systems sets out a systematic process for identifying and managing environmental issues. It is based on ISO's quality management program with its continual cycle of planning, implementation, measurement and evaluation, and review and improvement.

The Selkirk and Brandon Thermal Generating Stations were selected as the initial sites for developing Manitoba

Hydro's environmental management system. By the end of 1998, management and staff at the two stations had completed the first two steps of the planning phase and were progressing with the final planning step, while other facilities are at various stages of the planning phase (see matrix the next page).

The three planning steps are:

1. **Preparing Activity Profiles:** Management and staff chart all activities at their facilities and the ways in which these activities impact the environment.
2. **Determining Impact Significance:** The significance of the environmental impacts are determined. Various factors are considered, including the nature and sensitivity of the receiving environment and potential impacts on people. Relevant legislation, corporate policies, industry standards and public expectations are also noted, along with methodologies and technologies for mitigating environmental impacts.
3. **Establishing Objectives and Targets:** In the final planning phase, management and staff establish objectives and targets and identify programs for managing the impacts. Priorities are then established and responsibilities assigned. The explicit objectives and targets will make it easy in the future to measure and audit the success of the environmental management programs and, when necessary, to follow with corrective action.

Along with preparing individual environmental management systems for specific sites, broader systems are also being developed for facilities and departments with common activities. Overarching all these environmental management systems will be a Corporate approach with objectives, targets and programs for Corporate-wide activities.

During 1999 the Corporate and Power Supply units will complete the planning phase and begin implement-

ing their environmental management programs, and by 2000 they will all be able to measure and evaluate their progress. In the continual improvement cycle, management and staff will revisit their environmental management systems regularly and, where appropriate, establish new objectives, targets and programs.

As these environmental management systems become operational, planning for environmental management systems in the rest of the Corporation will begin.

Implementation of Environmental Management Systems at Manitoba Hydro Generating and Converter Stations — 1998

Station	Preparation of Activity Profiles	Determination of Impact Significance	Establishment of Objectives & Targets
Brandon	▲	▲	■
Selkirk	▲	▲	■
Long Spruce	▲	■	■
Kettle	▲	■	■
Limestone	▲	■	■
Kelsey	●	■	■
Jenpeg	■	■	■
Grand Rapids	■	■	■
Winnipeg River	■	■	■
Radisson	▲	■	■
Henday	▲	■	■
Dorsey	●	■	■

- ▲ Initiated and implemented in 1998
 ● Initiated in 1998 and to be implemented in 1999
 ■ To be initiated and implemented in 1999

Principles of the Environmental Commitment and Responsibility Program



The Canadian Electricity Association's Environmental Commitment and Responsibility Program is guided by the following four principles:

1. To be more efficient in our use of resources.
2. To reduce the adverse environmental impact of our business.
3. To be accountable to our constituents.
4. To ensure our employees understand the environmental implications of their actions and have the knowledge and skills to make the right decisions.

A commitment to meet global greenhouse gas targets

International scientists — most notably, the Intergovernmental Panel on Climate Change — expect global temperatures will increase with the growing concentration of greenhouse gases in the earth's atmosphere. An increase in the earth's temperature could result in serious consequences for ecosystems and severe-weather events, among other impacts.

As a result the international community has agreed to reduce the production of greenhouse gases. In December, 1997, at Kyoto, Japan, industrialized countries agreed to cut their greenhouse gas emissions by an average of 5.2% below 1990 levels, with Canada committing to a 6% reduction. The target date to achieve these greenhouse gas reductions is between 2008 - 2012.

The electrical industry is one of the major sources of greenhouse gases, produced when fossil-fuels such as coal and gas are burned at thermal generating stations. However, because Manitoba Hydro relies heavily on water-powered hydroelectric generating stations, we produced only 0.1% of Canada's total greenhouse gases in 1990.

In 1990 Manitoba Hydro produced the equivalent of 0.53 megatonnes of greenhouse gases. Almost 95% of these gases came from our two coal-fired generating stations. The other two sources of greenhouse gases were diesel-fuelled generating stations in remote communities and fleet vehicles.

Even with these low outputs, Manitoba Hydro expects to do better in the future.

In 1998 Manitoba Hydro made a commitment to reduce greenhouse gas emissions between 1991 and 2012 by an average of 6% below 1990 levels. This 22 year commitment exceeds Canada's national commitment, which focuses on a 6% reduction between 2008 to 2012. We expect our hydroelectric generation will enable us to achieve this commitment. But should circumstances such as drought force us to rely on more fossil fuel generation, we will purchase greenhouse gas credits, if necessary.

Manitoba Hydro's strategy for reducing greenhouse gases includes:

- An increase in our reliance on hydroelectricity, which produces insignificant amounts of greenhouse gases. The 1330-megawatt Limestone Generating Station, which came into full production in 1992, increased our electrical capacity by 25%.
- A decreased reliance on coal-fuelled generation, which is our major source of greenhouse gases. Four thermal generating units were laid-up at the Brandon Generating Station in 1996, reducing our thermal generating capacity by about one-third at that time, and the Selkirk coal-fired generators may be removed from service in 2005. As a result, greenhouse gas emissions from coal-fired generators will fall to 45% of 1990 levels.
- Six communities previously served by diesel-fuelled generators had been connected to the provincial power grid between 1990 and 1998, and another three were to be connected in 1999, resulting in 12.79 megawatts of diesel-generating capacity being removed from service. By 2010, emissions from diesel generators will be over 50% below 1990 levels.
- Demand-side energy initiatives have resulted in a saving of 139 megawatts since 1990, and supply-side energy initiatives, 152 megawatts.

While reducing our greenhouse gas emissions, we expect to increase our annual energy production from 19,200 gigawatt hours in 1990 to 28,800 gigawatt hours in 2010, an increase of 38%.

Our recent performance is largely consistent with these targets. In fiscal 1997/98, 0.35 megatonnes of greenhouse gases were emitted from operations, 33% below the 1990 baseline of 0.53. In 1998/99, however, emissions rose to 1.04 megatonnes. Emissions were higher due to changing market conditions and lower river flows. With higher electricity export values, our coal-fuelled generation stations were used more than in recent years.



Iskatingup Falls, 1.5 kilometers downstream of Waskesiu Lake, could produce 200 megawatts of power and cause almost no flooding

Energy in Manitoba rivers may contribute to global efforts

Manitoba Hydro is committed to reducing greenhouse gas emissions by 6% within its operations and anticipates even better results — a reduction in excess of 40% — under normal operating conditions by 2010.

But the contribution which Manitoba can make to national and international efforts is potentially much larger.

Manitoba's significant undeveloped hydroelectric potential could provide customers in Manitoba and beyond with important energy with virtually no associated greenhouse gas production. If the potential of the 10 most economic sites is realized, Manitoba's hydraulic generating capacity could double to 10,000 megawatts. This energy could be used to power our economy while contributing to our international environmental responsibilities.

At the present time we do not expect to develop any of this power to serve Manitoba customers until 2014.

But these plans could be advanced under appropriate market conditions and with the implementation of supportive government policies.

To help realize this potential, the Government of Manitoba has put forward recommendations for consideration in a national and international policy framework. The provincial government plan includes the following components:

- The development of a national grid so regions without hydroelectric resources may benefit from these competitively-priced renewable energy resources.
- A tax regime which favours renewable hydroelectric and other specific energy technologies contributing to greenhouse gas reductions.
- National and international recognition of major hydroelectric generation as a renewable energy resource which can significantly contribute to greenhouse gas reductions to meet the objectives of the Kyoto Protocol.

Manitoba Hydro supports these recommendations and continues to work toward a state of readiness should the opportunity for additional hydroelectric development arise sooner than currently anticipated.

SELECTED ENVIRONMENTAL MANAGEMENT ACTIVITIES-1998

Licensing and Assessment

ENVIRONMENTAL APPROVALS OBTAINED

Pointe du Bois to Bernic Lake 138 kV Transmission Line
Churchill River Weir and Marina
Maple Leaf 115 kV Station
Rossier-Silver 230 kV Transmission Line
RD 52/BK 41 Transmission Line Rebuild
St. Boniface-Plessis Road 115 kV Station
Grand Rapids Waste Disposal Sites Rehabilitation
Southern Indian Lake Waste Metal Disposal
Ash Utilization

SITE SELECTION AND ENVIRONMENTAL ASSESSMENTS

New Brereton Area Lake Station Area Project	Continuing
St. Boniface Road 115 kV Station	Completed
Dorsey-St Vital 230 kV Transmission Line	Completed
Gull Lake 115 kV Station	Continuing
Pointe Du Bois-Bernic Lake 138 kV Transmission Line	Completed
Rossier-Silver 230 kV Transmission Line	Completed
Churchill Weir and Marina	Completed
Maple Leaf 115 kV Station	Completed
RD 52/BK 41 Rebuild (115 kV)	Completed
Flin Flon Transmission Improvements	Completed
Ilford Transformer Station	Initiated
Leaf Rapids Transformer Station	Initiated
Ruttan Mine Transformer Station	Initiated
Gillam Transformer Station	Initiated

ENVIRONMENTAL SELF-ASSESSMENTS*

Bank Stabilization and Repair Projects	Continuing
MacArthur Generating Station Gate Re-Painting	Continuing
Seven Sisters/Grand Rapids Synchronous Condenser Testing	Completed
Seven Sisters Concrete Rehabilitation	Completed
Maintenance Bridge, Riding Mountain National Park	Continuing
Jenpeg-Norway House 66 kV Sub-transmission Line	Initiated
Notigi Exploratory Drilling & Seismic Program	Completed
Sprague to the North West Angle Express Line	Completed
Sub-transmission & Distribution Line-River Hills Area	Completed
Salvage of 66 kV Line, Pukatawagan	
Line Tap-Fox Lake Mine	Completed
Wuskwatim Exploratory Drilling	Continuing

Environmental Protection Plans

North Central Project, Vols 1-6, Vol 7
Flin Flon to Birch Lake Mine
Cross Portage Burial Site
Dorsey-Neepawa-Brandon 230kV Transmission Line
Sprague-Moose Lake 25 kV Express Line to supply the Northwest Angle
Churchill Weir

Environmental Audits

ENVIRONMENTAL AUDITS OF FACILITIES

Grand Rapids Generating Station	Completed
Great Falls Generating Station	Completed
Kelsey Generating Station**	Draft Report
Radisson Converter Station	Completed
Selkirk Service Centre**	Completed
Thompson Service Centre	Completed
Brandon Generating Station	Completed
Jenpeg Generating Station	Completed
Long Spruce Generating Station	Completed
Selkirk Generating Station	Completed
Waverley Service Centre	Completed
Dorsey Converter Station	Planned for 1999
Henday Converter Station	Planned for 1999
Limestone Generating Station	Planned for 1999
Seven Sisters Generating Station	Planned for 1999
Letellier (T&D) Station	Planned for 1999

DISTRICT OFFICE AUDITS (Specific Program Module)

Beausejour, Birtle, Boissevain, Falcon Lake, Grandview, Hamiota, Killarney, Melita, Niverville, Norway House, Reston, Roblin, Russell, St. James, St. Martin, St. Pierre, Selkirk, Steinbach, Stonewall, Transcona, and Virden
Swan River and in the Brandon area at least two of: Brandon, Carberry, Glenboro, Killarney, MacGregor, Pilot Mound, and Treherne
In the Portage la Prairie area at least two of: Altona, Carman, Elie, Morden, Morris, Portage la Prairie, Somerset, and Winkler

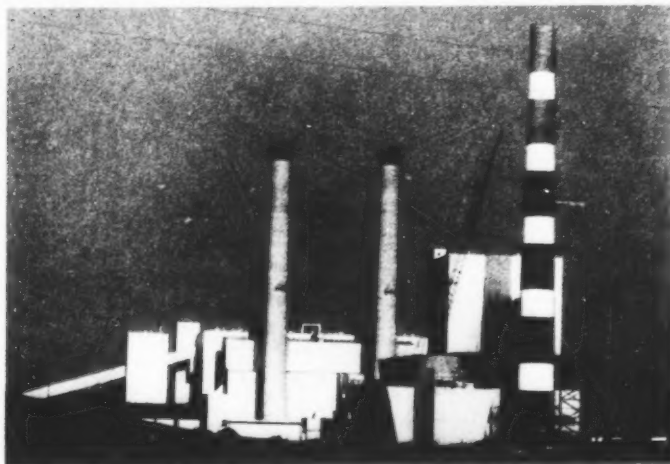
Completed

Planned for 1999

Planned for 1999

* Manitoba Hydro conducts environmental self-assessments of lines rated lower than 115kV. Such lines are generally not subject to an assessment under the Manitoba Environment Act. Environmental self-assessments combine environmental screening and environmental protection plans.

** Environmental/Comprehensive Audits integrate occupational and public health, safety, and environmental control issues in comprehensive audits.



Left photo
A licence was received in 1998 to utilize ash from the Brandon thermal generation station

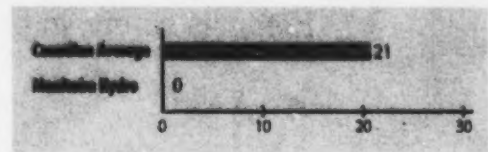
Alternative use approved for ash

Ash is produced when coal is burned at thermal generating stations. Manitoba Hydro deposits this by-product in specially-constructed lagoons adjacent to its thermal generating stations.

Although the ash has not been utilized for other purposes in the past, this should change in the future. Based on scientific analysis and an environmental assessment, an environmental licence was received in 1998 to enable other companies to use the ash as a concrete additive, backfill material for road bases, fill and dykes, and a cover for landfills.

As a result, some ash could be diverted to construction projects in the future, and we should make a positive contribution to industry efforts to utilize solid combustion by-products. Ten utility members of the Canadian Electricity Association increased their productive use of these products from 18% in 1997 to 21% in 1998.

Utilization of solid combustion by-products



Atmospheric emissions from fossil fuel generating stations

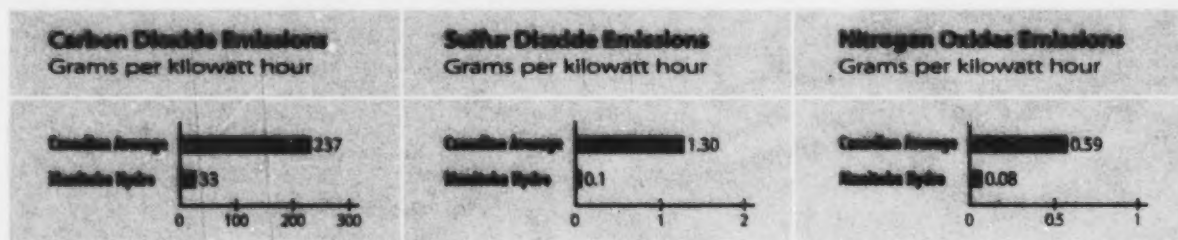
Atmospheric emissions, such as carbon dioxide, sulfur dioxide and nitrogen oxides, are produced when fossil fuels are burned at thermal generating stations. The Canadian Electricity Association measures atmospheric emissions based on a mass emitted per unit of electricity:

- Generated by fossil-fuel generating stations; and

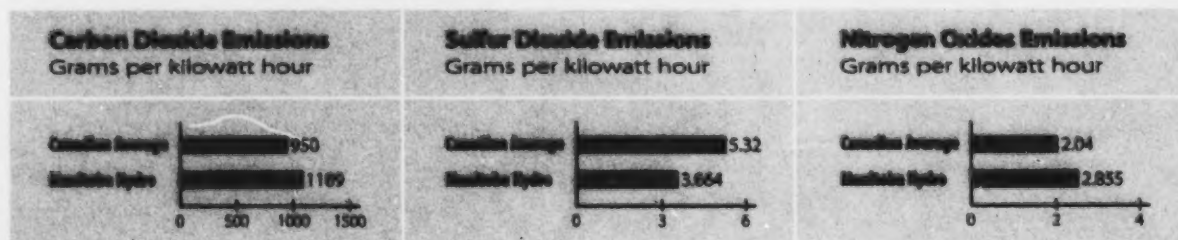
- Generated by all generating stations, including those such as hydroelectric (water powered) stations which do not burn fossil fuels.

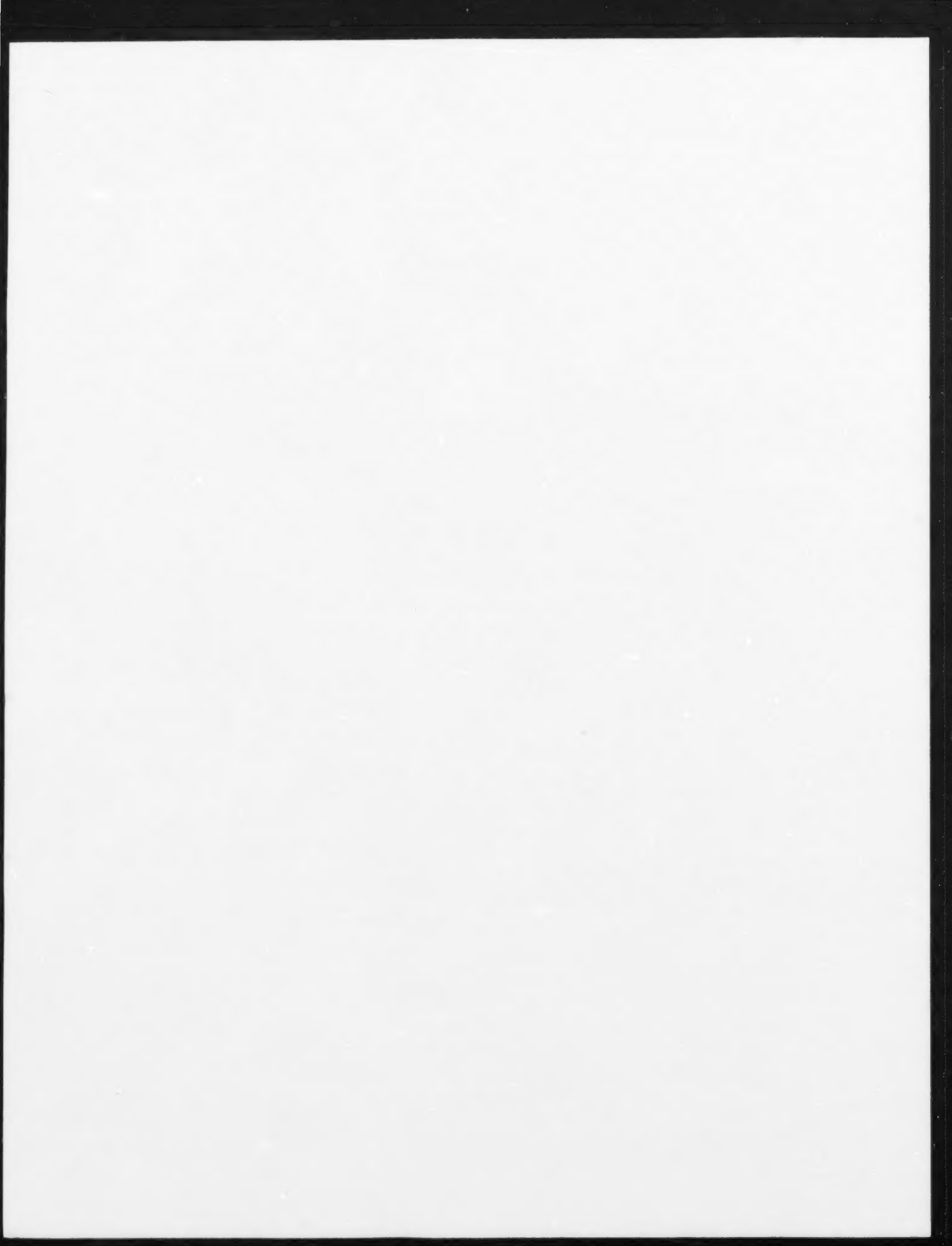
Because 95% of Manitoba Hydro's electricity is generated at hydroelectric (water power) sites, our emissions per unit of total system electricity are very low.

Emissions Per Unit of Electricity from Total System Generation — 1998



Emissions Per Unit of Electricity From Fossil Fuel Generation — 1998





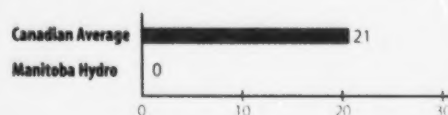
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Utilization of solid combustion by-products



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- Generated by fossil fuel generating stations, and

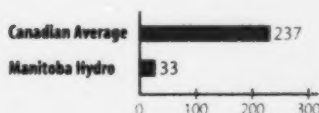
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Emissions Per Unit of Electricity from Total System Generation — 1998

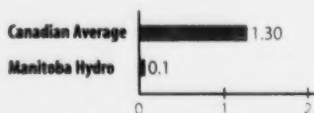
Carbon Dioxide Emissions

Grams per kilowatt hour



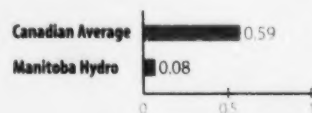
Sulfur Dioxide Emissions

Grams per kilowatt hour



Nitrogen Oxides Emissions

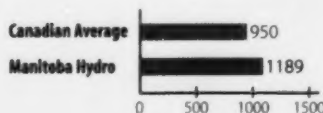
Grams per kilowatt hour



Emissions Per Unit of Electricity From Fossil Fuel Generation — 1998

Carbon Dioxide Emissions

Grams per kilowatt hour



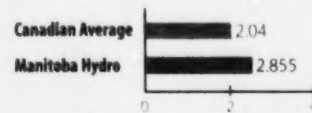
Sulfur Dioxide Emissions

Grams per kilowatt hour



Nitrogen Oxides Emissions

Grams per kilowatt hour



Products screened before purchase

Manitoba Hydro screens chemical products which may pose a threat to the safety and health of our employees, the public and the environment.

In 1998, of 155 products screened, 17 were approved, 74 were rejected, and 64 were approved with conditions

placed on their purchase and/or use. Many of those products not approved contain 1, 1, 2-trichloroethylene, a chemical considered an environmental hazard.

Over 1,400 products have been evaluated since the program began in 1992.

Staff go distance to clean up small spill

In 1998 Manitoba Hydro staff managed 84 spill cleanups. Of these, 36 were reported to regulatory authorities (reportable spills are those which exceed 68 litres of insulating oil or other petroleum products, 45 parts per million of PCBs, or 10 or more kilograms of ozone-depleting substances). Another 48 were smaller non-reportable spills, but which we track for our own records.

In addition, the Canadian Electricity Association categorizes spills as "priority" spills if they involve petroleum products or PCB-contaminated substances in which the spill volume is greater than 500 litres, the spilled substance enters a waterbody, or the spill is reported in the media. Five of Manitoba Hydro's 36 reportable spills were within the CEA's priority spill criteria.

In at least one case, staff had to really "go the distance" to perform their duties. Scientists conducting field studies for Manitoba Hydro noticed mercury on a rock outcrop on the shore of Threepoint Lake, south of Nelson House on the Burntwood River system. Larger droplets were collected when they were discovered, and staff equipped with vacuum equipment travelled from Winnipeg to do a complete clean up.

An estimated 30 millimeters of mercury had apparently been released from a decommissioned water level recorder.

The decommissioning process for recorder sites has been reviewed to guard against similar events in the future.

Reportable and Non-Reportable Spills

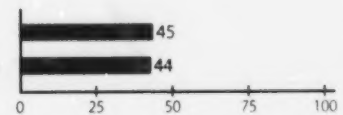
1994

Reportable

45

Non-Reportable

44



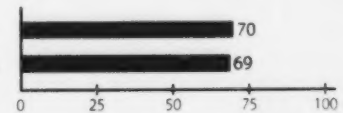
1995

Reportable

70

Non-Reportable

69



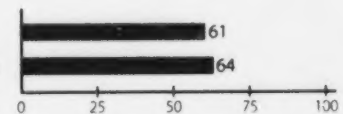
1996

Reportable

61

Non-Reportable

64



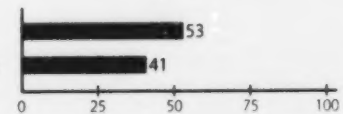
1997

Reportable

53

Non-Reportable

41



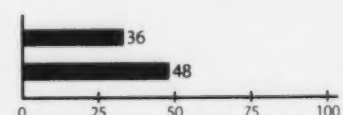
1998

Reportable

36

Non-Reportable

48



Reportable spills: Must be reported to regulators.

Non-reportable spills: Not required to be reported to regulators.

Staff trained to handle hazardous spills

Manitoba Hydro staff are provided with periodic training on proper procedures for handling spills of hazardous materials. In 1998, 103 employees received the 2- to 4-hour introduction course, 274 employees participated in the 8-hour intermediate "hands on" program, and 56 participated in the 2- to 3-day advanced program which includes training on waterway cleanups.

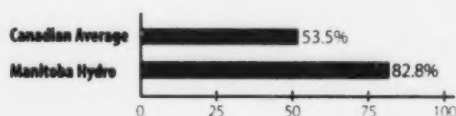
The Canadian Electricity Association posed four questions to assess utilities' employee awareness and training programs. The following are the results of this questionnaire:

- 50% know how many employees require environmental training. Manitoba Hydro does not have a formal process to determine training needs at this time.

- 58% of Canadian electricity utilities have implemented a procedure to identify environmental training needs. While Manitoba Hydro at this time has no formal procedure to identify all environmental training needs, development of these procedures has begun.
- 54% of the utilities, including Manitoba Hydro, have a procedure to track the number of employees who require environmental training.
- 69% of the utilities, including Manitoba Hydro, know how many staff have received some environmental training.

Electrical insulating oil reconditioned

Reuse of Electrical Insulating Oil



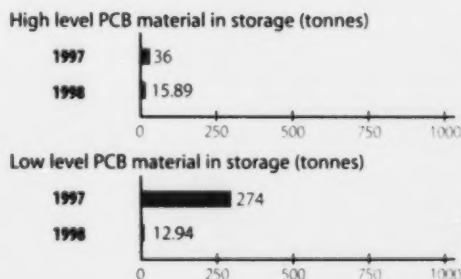
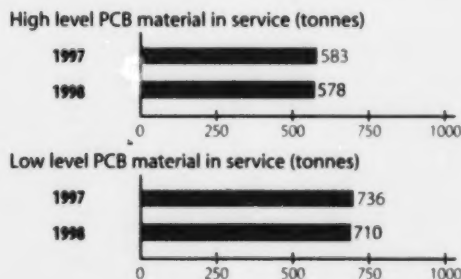
The Canadian Electricity Association measures the extent to which member utilities reduce consumption of new insulating oil by reusing existing inventories that may otherwise have been disposed of as waste or recycled for another purpose. Manitoba Hydro reconditions all the insulating oil which we call rework and equipment. However, not all of the used oil which is accumulated can be re-used, and the remainder is sold for energy recovery.

Equipment tested, decontaminated and phased out

Consistent with regulatory and Canadian Electricity Association protocols, Manitoba Hydro tracks the amount of PCB material in use and in storage in its system. PCBs were once used in electrical equipment because of their cooling, insulating and non-flammable

properties, but they have not been produced since 1983. Manitoba Hydro is systematically testing, decontaminating and phasing out equipment with PCBs. Material with PCBs is tested, reconditioned, if feasible, and delivered to approved facilities for destruction.

PCB Materials in Use and Storage – Estimated



Products screened before purchase

Manitoba Hydro screens chemical products which may pose a threat to the safety and health of our employees, the public and the environment.

In 1998, of 155 products screened, 17 were approved, 74 were rejected, and 64 were approved with conditions

placed on their purchase and/or use. Many of those products not approved contain 1, 1, 2-trichloroethylene, a chemical considered an environmental hazard.

Over 1,400 products have been evaluated since the program began in 1992.

Staff go distance to clean up small spill

In 1998 Manitoba Hydro staff managed 84 spill cleanups. Of these, 36 were reported to regulatory authorities (reportable spills are those which exceed 68 litres of insulating oil or other petroleum products, 45 parts per million of PCBs, or 10 or more kilograms of ozone depleting substances). Another 48 were smaller, non-reportable spills, but which we track for our own records.

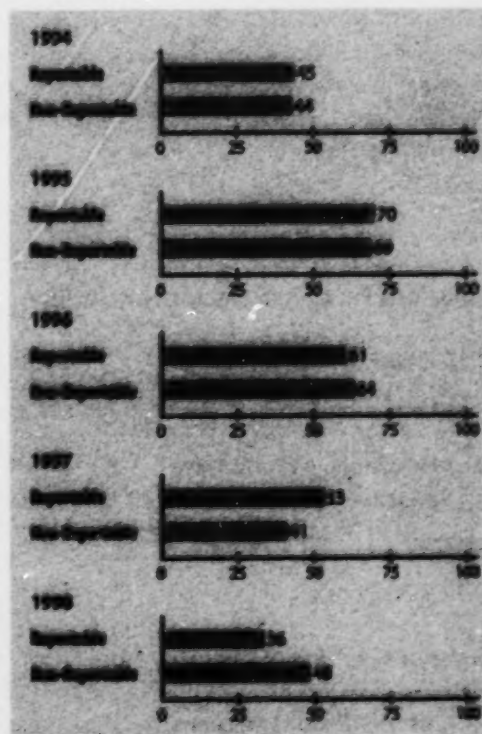
In addition, the Canadian Electricity Association categorizes spills as "priority" spills if they involve petroleum products or PCB-contaminated substances in which the spill volume is greater than 500 litres, the spilled substance enters a waterbody, or the spill is reported in the media. Five of Manitoba Hydro's 36 reportable spills were within the CEA's priority spill criteria.

In at least one case, staff had to really "go the distance" to perform their duties. Scientists conducting field studies for Manitoba Hydro noticed mercury on a rock outcrop on the shore of Threepoint Lake, south of Nelson House on the Burntwood River system. Larger droplets were collected when they were discovered, and staff equipped with vacuum equipment travelled from Winnipeg to do a complete clean up.

An estimated 30 millimeters of mercury had apparently been released from a decommissioned water level recorder.

The decommissioning process for recorder sites has been reviewed to guard against similar events in the future.

Reportable and Non-Reportable Spills



Reportable spills: Must be reported to regulators.

Non-reportable spills: Not required to be reported to regulators.

Staff trained to handle hazardous spills

Manitoba Hydro staff are provided with periodic training on proper procedures for handling spills of hazardous materials. In 1998, 103 employees received the 2- to 4-hour introduction course; 274 employees participated in the 8-hour intermediate "hands on" program; and 56 participated in the 2- to 3-day advanced program which includes training on waterway cleanups.

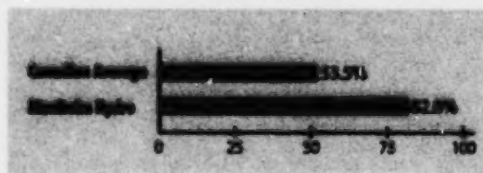
The Canadian Electricity Association posed four questions to assess utilities' employee awareness and training programs. The following are the results of this questionnaire:

- 50% know how many employees require environmental training. Manitoba Hydro does not have a formal process to determine training needs at this time.

- 58% of Canadian electricity utilities have implemented a procedure to identify environmental training needs. While Manitoba Hydro at this time has no formal procedure to identify all environmental training needs, development of these procedures has begun.
- 54% of the utilities, including Manitoba Hydro, have a procedure to track the number of employees who require environmental training.
- 69% of the utilities, including Manitoba Hydro, know how many staff have received some environmental training.

Electrical insulating oil reconditioned

Reuse of Electrical Insulating Oil



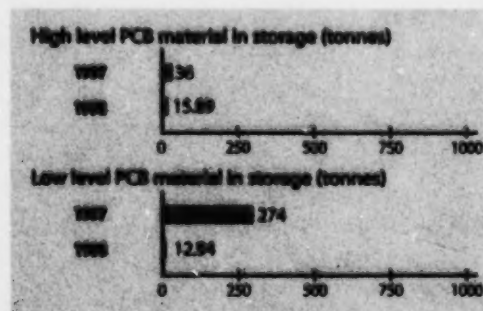
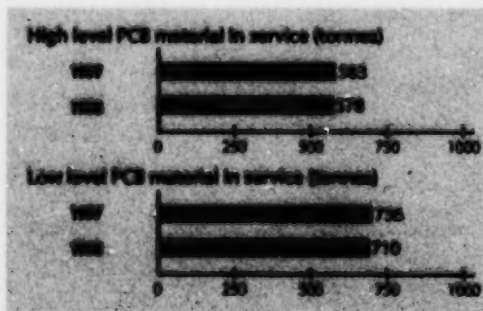
The Canadian Electricity Association measures the extent to which member utilities reduce consumption of new insulating oil by reusing existing inventories that may otherwise have been disposed of as waste or recycled for another purpose. Manitoba Hydro reconditions all the insulating oil which we can re-use in our equipment. However, not all of the used oil which is accumulated can be re-used, and the remainder is sold for energy recovery.

Equipment tested, decontaminated and phased out

Consistent with regulatory and Canadian Electricity Association protocols, Manitoba Hydro tracks the amount of PCB material in use and in storage in its system. PCBs were once used in electrical equipment because of their cooling, insulating and non-flammable

properties, but they have not been produced since 1985. Manitoba Hydro is systematically testing, decontaminating and phasing out equipment with PCBs. Material with PCBs is stored in licensed facilities and delivered to approved facilities for destruction.

PCB Materials in Use and Storage – Estimated



Reuse and Recycling at Manitoba Hydro — 1998 Highlights

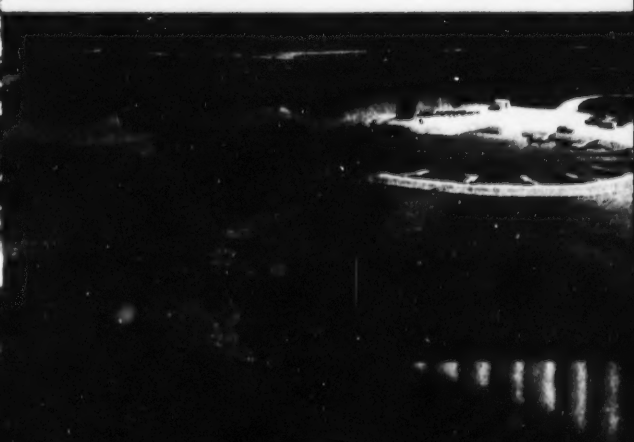
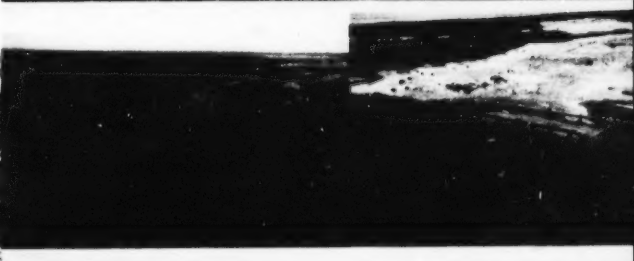
Material	Quantity	Handling
Non-hazardous		
Used electrical apparatus	1 334	Refurbished and reused single-phase transformers, where cost-effective. Electrical apparatus that cannot be repaired is sold to scrap dealers for recycling.
Transformers (scrap)	458 135 kilograms	Drained, scrap transformers are sold to scrap dealers for recycling of metals.
Scrap steel and bolts	162 142 kilograms	Surplus steel and bolts that cannot be reclaimed are sold to scrap dealers for recycling.
Scrap metres	7 770 kilograms	Sold to scrap dealers for recycling.
Conductor (wire)	150 037 kilograms	116 760 kilograms sold to scrap dealers for recycling; 33 257 kilograms repaired and reused in system.
Copper	96 173 kilograms	Sold to scrap dealers for recycling.
Scrap aluminium	2 114 kilograms	Sold to scrap dealers for recycling.
Fine office paper	180 tonnes	Recovered at Winnipeg sites or backhauled from some rural locations. A local contractor recycles white paper into office, newsprint, and tissue products, and non-white paper into boxboard, cardboard, and insulation. Some rural sites are contracted to local recyclers.
Toner cartridges	1107	Some types are collected and refurbished by a contractor and returned for re-use. Balance to landfill.
Phone directories	7 tonnes	Collected by Manitoba Telecom Services; reprocessed for shingling, roofing paper, and egg trays.
Cardboard/other packaging	13240 kilograms	Some reused for shipping. Surplus cardboard is collected by outside contractor for reprocessing.
Wood pallets		Standard pallets are reused at Manitoba Hydro.
Yard wastes	N/A	Grass clippings and tree/shrub cuttings from the corporation's grounds are composted and returned to condition flower beds.
Office newsprint	630 kilograms	Removed by a private contractor and added to virgin newsprint fibre. At Head Office only.
Aluminum cans	886 kilograms	Removed by a volunteer. Donated to a Selkirk non-profit collection agency for recycling.
Tires	300	Long-wearing tires used on vehicles to minimize tire changes. Used tires total more than 300 annually (about 5% of the corporate-wide total; see footnote). A local contractor collects the used tires and recycles them into floor mats and other products.
Salvaged scrap poles	565	Some salvaged poles are reused as is or cut to another common size and put back in stock. Remaining poles are sold as scrap.
Street light luminaries	932	When damaged or obsolete street lights are replaced, they are returned to Manitoba Hydro for recycling, reuse, or disposal. To date, 192 450 have been reused in the system after repair.
Dismantled walls	N/A	Three-quarters of these interior wooden partition walls are re-used internally.
Used/worn carpet	N/A	Returned to manufacturer for re-manufacturing into new carpet.
Hazardous		
Aerosol containers	2 250 containers	Containers are punctured and the contents collected as mixed solvent and shipped to a hazardous waste facility. Containers are sent to a local scrap metal dealer for recycling.
Batteries—acid	918	Sold to scrap dealers for recycling.
Waste lubricating oil	155 442 litres	Used lubricating and hydraulic oils are recycled by a hazardous waste contractor.
Decontaminating insulating oil	1 549 370 litres	Since 1985 Manitoba Hydro has chemically destroyed PCBs in insulating oil using a registered process. Once PCBs are removed, oil is renewed and reused in oil-filled electrical apparatus.
Oil/diesel fuel filters	45 drums	Filters are sent to a local recycler. Filter casings are disposed of as scrap material.
Waste solvents	13 120 litres	Hazardous waste contractors collect waste solvents and blend them off-site with waste fuels, which are then used for fuel in asphalt plants and cement kilns.
Antifreeze	6 150 litres	Used antifreeze is collected and shipped to a hazardous waste facility.
Paints	205 litres	Some surplus paints are donated to a local charity. The remainder are incinerated as hazardous waste by a contractor.
Grease	4 715 litres	Disposed of through a waste contractor, incinerated, or mixed and burned.
PCBX waste	19 475 litres	Waste from PCB treatment comprising Fuller's earth, caustic water, or polymer is disposed of through a waste contractor.
Bulbs—fluorescent	7 898	Shipped off-site to lamp recycler for crushing. Aluminum, glass, phosphor powder, and mercury reused.
Bulbs—HID (mercury & sodium vapour)	14 640	Shipped off-site to lamp recycler for crushing. Glass, brass, aluminum, lead, and mercury are reused by industry.
PCB transformers <200 ppm decontaminated	665	Decontaminated to <45 ppm of PCBs and reused in our system or sold to scrap dealers.
PCB transformers >200 ppm decontaminated	73	Decontaminated to <45 ppm of PCBs and reused in our system or sold to scrap dealers.
Plastic	2 000 kilograms	Plastic #2, HDPE, and #4 LDPE are shipped to a manufacturer of plastic wood products such as fence posts, decking, and parking lot abutments.

NOTE: N/A—Not available. This table covers recyclable materials handled and received in Winnipeg only. Several rural districts/regional offices utilize collectors and processors in their own areas.

Selected Fisheries/Aquatic Environment Programs — 1998 Highlights

PROGRAM	DESCRIPTION
Monitoring	
Churchill River Diversion Shoreline Erosion	Annual monitoring of shoreline profiles to document rates of shoreline development in various soils and exposure situations.
Grand Rapids Water Chemistry	Ongoing monitoring upstream and downstream of Grand Rapids Generating Station in summer and winter to build baseline information on water chemistry.
Limestone/Nelson River Aquatic Monitoring Studies	Year nine of an aquatic monitoring program that focuses on monitoring fish populations distribution, habitat, and migration, both upstream and downstream of Limestone Generating Station as well as in tributaries.
Churchill Weir Construction	Monitoring of construction to examine the effects of building the weir, Goose Creek enhancement, and other associated works focused on water chemistry and the effects of blasting and other disturbances on belugas and harbour seals.
South Indian Lake-Water Chemistry	Support for a Department of Fisheries and Oceans program to repeat water chemistry, benthos, and fish presence and abundance monitoring surveys from the 1970s and 80s.
York Landing	Development of an aquatic monitoring program and a plan for applying it. The program monitors water circulation, sedimentation and biological indicators of change to achieve an understanding of local aquatic environments.
Split Lake	Development of an aquatic monitoring program and a plan for applying it. The program monitors changes in fish and aquatic insect populations, water chemistry, sedimentation rates, turbidity, dissolved oxygen, and other indicators of change to achieve an understanding of local aquatic environments.
Nelson House/Burntwood River	Implemented an aquatic study program that will provide information for use in monitoring changes that could result from developments along the Burntwood River.
Cedar Lake	Development of an ecosystem model for Cedar Lake as well as a work plan to implement a program to monitor water chemistry, fish, invertebrates, and other indicators of ecosystem change.
Cross Lake	Year seven of a program to determine the response of fish populations, particularly lake whitefish, to the construction and operation of the Cross Lake Weir, a mitigation project designed to stabilize water levels on Cross Lake.
Sturgeon in Lower Nelson	Documentation of sturgeon spawning activities and habitat on the Lower Nelson River.
Mercury Levels*	An eight-year program, conducted jointly by Manitoba Hydro, Department of Fisheries and Oceans, and Manitoba Natural Resources, to determine mercury levels in reservoirs and associated sites in Manitoba.
Water Quality at Dorsey, Brandon, and Selkirk	Monitoring the water quality of effluent and surface water at Dorsey, Brandon, and Selkirk in keeping with the requirements of Environment Act Licences.
Selkirk Thermal Generating Station — Intake Screen Counts	Enumeration of impinged fish on cooling water intake screens at Selkirk Thermal Generating Station to determine the impact of the station.
Selkirk Thermal Generating Station — Entrainment of Fish	Monitoring the entrainment of fish to assist in determining the overall impact of operating the generating station.
Inventory	
Nelson River Estuary	Baseline information study to gain a better understanding of the estuary environments. Results will assist in assessing the effects of hydroelectric development on Hudson Bay.
South Indian Lake-Mark and Recapture	Mark and recapture program to examine the movements of lake whitefish and other key species in South Indian Lake.
Lower Churchill River Water Level	Aquatic and terrestrial studies conducted to determine the potential positive and negative effects of the construction and operation of a weir on the Churchill River. The weir was constructed in 1998 to increase water levels.
Mitigation and Remediation	
Selkirk Station Operational Modifications	Application of several measures, including limiting spring operation and minimizing water withdrawals through the cooling system to keep fish out of the cooling water stream.
Red River Fish Distribution, Habitat, and Water Quality	Studies of fish entrainment and impingement, thermal effluent, and ambient water temperatures to set temperature limits for the Selkirk Thermal Generating Station. Assisted in developing recommendations on the most appropriate design for an intake screen for the station.
Grand Rapids Fish Hatchery*	Annual support for operation of the Grand Rapids fish hatchery which is used to produce walleye for stocking walleye at Grand Rapids, whitefish in Cross Lake, and sturgeon in waters affected by corporate projects.
Winnipeg River Bank Stabilization*	Placement of riprap on banks of reaches of the Winnipeg River to stabilize erosion-prone areas.
Sturgeon Management Committees*	Participation with local committees, Manitoba Fisheries Branch, Fisheries and Oceans Canada, and Indian Affairs on the Manitoba Sturgeon Management Committee and the Nelson River Sturgeon Management Board. Also provided support for Saskatchewan River sturgeon investigations.
Nelson River Sturgeon Co-Management Board	Ongoing studies to help enhance sturgeon populations in the Nelson River. Efforts include taking inventory to determine current stocks, managing the harvest of sturgeon on the Nelson, assessing habitat availability, and stocking.
Goose Creek Enhancement Reach	Construction of feeding, spawning, and overwintering habitat in a reach of Goose Creek immediately downstream of the Churchill Weir.
Lower Churchill River Water Level Enhancement Weir	Increasing recreational boating and fishing along the lower reaches of the Churchill River by raising water levels as much as 10 kilometres upstream of the weir.
Management Programs	
Fisheries Act Revisions	Ongoing participation on a national utilities working group to develop and review input to pending changes to the Fisheries Act.
Habitat Enhancement	
Grand Rapids Spillway	Year two of a six-year program designed to establish a self-sustaining spawning population of walleye in the Grand Rapids spillway channel by creating walleye spawning habitat, providing sufficient flows during the spawning period, and stocking walleye eggs and larvae in the spillway channel.

*Co-funded with other partners



Churchill Weir improves local environment

A weir constructed across the Churchill River in 1998 has increased water levels in the river, improving habitat for fish and recreational opportunities for local residents.

The 4-kilometer weir is just upstream from the estuary where the river's fresh water mixes with salt water from Hudson Bay.

Manitoba Hydro undertook the \$14 million Lower Churchill River Enhancement Project to improve the local environment as part of an agreement with the Town of Churchill to compensate for effects from the Churchill River Diversion. Constructed in the late 1970s, the diversion routed two-thirds of the water from the Churchill River into the Nelson River to add to the water flowing through hydroelectric generating stations.

The enhancement project, undertaken in 1998, was a collaborative team effort involving Town of Churchill officials, local residents, and Manitoba Hydro. Local residents and officials have been involved in planning the project, with a multi-party committee overseeing project construction.

Water levels at the weir have risen 2 metres, with a new 10-kilometer reservoir being created upstream. This larger, deeper body of water will result in larger populations of fish species such as northern pike and lake whitefish.

Improvements were also made to Goose Creek, which drains into the Churchill River. The enhancements in the lower 1.5 kilometers of the creek were designed to create spawning, feeding and overwintering habitat for Arctic grayling, brook trout, and other fish species.

Rainbow trout may be stocked in a quarry which supplied rock for the weir, once water conditions in the quarry are favourable for fish.

The project took several years to plan in collaboration with scientists and local interests. Environmental approval from government regulators was received in

early 1998, and aided by a warm fall the project was completed in one unusually long northern construction season. [Editor's Update: In 1999 a viewing tower, marina, and an island for bird habitat were completed.]

Special care had to be taken in planning and constructing a project of this magnitude in the sensitive sub-Arctic environment. Because the Churchill estuary supports one of the world's largest populations of beluga whales, the weir was sited upstream of the belugas' range of movements. Blasts to obtain rock from a nearby quarry were detonated during low tide when most belugas were farther downstream.

Seals sunning themselves on rocks were also monitored. At the sound of a blast, they would slip into the water and return to the rocks a few minutes later.

On the other hand, people also had to be protected from the region's most famous local wildlife — polar bears. The Arctic tundra around Churchill is one of the greatest polar bear denning regions in the world which, like the belugas, draws visitors from around the globe. Since polar bears can attack, bear watchers were armed with shotguns loaded with tele-shot which explodes loudly to scare off the bears without harming them.

At the rock quarry, special precautions were required when a burial site was discovered. An extensive buffer was left around the site, and local residents and a professional archeologist were consulted to afford the site proper respect. The site is being marked with a plaque inscribed in local aboriginal languages.

At the gravel quarry, the excavation was contoured to form two shallow ponds that now provide fresh water for a kennel of huskies.

The multi-party liaison committee organized to oversee project construction will continue to meet, reviewing the weir's operation and monitoring changes to the local aquatic environment.

*Photos, clockwise, from top left:
A scientist measures water flows; heavy equipment works on the weir; Goose Creek, which flows into the Churchill River; the fish passage between Churchill River and Goose Creek; the Churchill River marina; and Churchill, Provincial and Hydro officials work together on project plans*

An ecological approach to understanding aquatic environments

*Photo right:
A member of the
Nisichawayasihk Cree
Nation installs a sediment
trap to collect particles
settling on the bottom of
Wuskwatim Lake*

Communities along rivers and lakes with hydroelectric projects are working with scientists and Manitoba Hydro to monitor local aquatic ecosystems.

The collaborative monitoring approach began with the Split Lake Cree First Nation in 1997 and was expanded to the York Factory First Nation and Nisichawayasihk Cree Nation in 1998. [Editor's Update: The Chemawawin Cree Nation and Manitoba Hydro also began a similar, long-term monitoring approach on Cedar Lake in 1999.]

To develop these monitoring programs, traditional knowledge and scientific expertise are used to describe the present condition of local ecosystems and find ways of measuring how they may change over time. The first step is to develop a conceptual model of the aquatic ecosystem and identify major habitat types and their locations in the local area. The next step is to identify some elements of the ecosystem that can be measured to describe present conditions in the ecosystem and determine whether the ecosystem is changing over time. The measured elements, called indicators, provide information about important structures and/or functions of the ecosystem. Field programs to collect information about these elements are planned and carried out by the biologists and local resource users. By developing a long term monitoring program, normal variabilities and trends in the ecosystem can be determined, based on changes in the indicators.

Besides monitoring the state of the environment, local resource managers will be able to use information from the monitoring programs in their fisheries programs. The ecological monitoring programs on the Burntwood and Nelson River systems will also contribute to future environmental impact assessments required to plan, design and license new hydroelectric projects.



The programs being put into place today will influence monitoring of future projects once they are constructed in the future. The programs also provide benefits beyond improving scientific knowledge of local aquatic environments:

- Working relationships between local Cree Nations, biologists and Manitoba Hydro are developed;
- A few local residents are employed and trained in monitoring activities;
- Local residents will be able to complement their traditional knowledge with information gained through applying scientific approaches to measuring and analysing ecological changes; and
- The Cree Nations will be able to quantify and communicate changes to their environment.

At Split Lake, the Cree Nation's Tataskweyak Environmental Monitoring Agency was funded by Manitoba Hydro to work with scientists in designing an ecosystem monitoring program to serve the Cree Nation's interests. Along with collecting ecological information, the biologists worked closely with local officials in developing the focus of the monitoring program and

in employing and training local workers to perform monitoring duties. The program has collected information, literally, from the bottom up: the sediment in the water and at the bottom of the lake; the aquatic invertebrates that live there; and fish populations and the habitats they favour. Data have also been collected to describe water velocity, temperature, and clarity of the lake, and a depth map of the lake has been produced.

Two-and-a-half years of determining the existing ecological condition (i.e., the scientific baseline) will be completed in 1999, by which time Tataskweyak employees will have acquired the skills to continue monitoring selected ecosystem components should the local environmental agency wish to carry on these activities. [Editor's Update: In 1999 an assessment and monitoring program began in the Gull Rapids area, where a new hydroelectric generating station could be constructed in the future. Gull Rapids is also in the Split Lake Cree First Nation's resource area.]

The York Factory First Nation is located at York Landing on Split Lake at the mouth of the Aiken River. The monitoring program, begun here in 1998, focuses on the Aiken River, selected tributaries and the area where the Aiken River enters Split Lake.

Along the Rat-Burntwood River system, scientists are collaborating with the Nisichawayasihk Cree Nation. The monitoring program, begun here in 1998, is being expanded over a larger area in 1999 and will include a terrestrial component. Notigi and Wuskwatim Lakes, where new hydroelectric generating stations may be constructed, are receiving special attention.

Cedar Lake, on the Saskatchewan River, is the primary resource base for the Chemawawin Cree Nation. It also serves as the reservoir for the Grand Rapids generating station, one of the first northern generating stations in Manitoba, built in the 1960's. A long-term ecological monitoring program on Cedar Lake is being considered for the near future with the Cree Nation.

*Photo below:
Nisichawayasihk Cree
Nation members fish Notigi
Lake to collect samples
for ecological monitoring*



Cree Nation finds new uses for old logs

*Photo right:
An example of stacked
wall construction by the
Chemawawin Cree Nation.*

The Chemawawin Cree Nation is looking for new uses for old logs washed ashore around Cedar Lake.

One possibility may be stacked wall buildings. In 1998 the Cree Nation constructed a 15 x 20 metre building from logs harvested from the lake shores. The stack wall construction is an old technique in which a wall is built from logs stacked similar to those in a wood pile, and concrete is applied between the logs. The Cree Nation is optimistic this same technique can be used for other buildings, including homes.

The Cree Nation is also investigating a variety of other possible markets: driftwood for landscaping, woodchips (again for landscaping), floor cover for horse paddocks, and even hog barn filters. A mill at The Pas could also be a customer if laboratory tests conclude the wood meets the demanding standards to produce pulp and paper. Manitoba Hydro is supporting these Cree Nation initiatives.

The Cree Nation (again with support from Manitoba Hydro) began its efforts to clean up the logs around the lake in 1996. For the first two years the debris was simply collected and burned. The Cree Nation would prefer to establish commercial markets for the debris. If viable markets are established, the clean-up program could become economically self-sustaining, the wood could be used in an environmentally beneficial manner, and local employment could increase.

The logs on the shores of Cedar Lake are the result of flooding which occurred thirty years ago when the Grand Rapids Generating Station began operations. The Grand Rapids project, one of our first in northern Manitoba, resulted in about one-half of the flooding caused by Manitoba Hydro's northern hydroelectric projects. We are also investigating expanding debris cleanup programs on other waterways.



Solution for fish caught in water intake

It is normal for some fish to be drawn into cooling water intakes of thermal generating stations, which require water for their operation. Until the spring of 1998 the numbers were relatively low at the Selkirk Generating Station.

Historically the station is operated most during the winter when domestic demand for electricity is highest. But in 1998 the Selkirk Generating Station continued to operate from spring to fall when mechanical outages and drought-like conditions on the Winnipeg River significantly affected our hydroelectric generation capacity.

During 1998 over 20,000 fish were trapped. Many were the size of minnows: one-third were immature carp less than 10 centimeters long. But as well, many were 20 centimeters and longer. Juvenile sauger were most affected, representing 40% of the total.

[Editor's Update: A temporary boom and curtain was installed in the spring of 1999 to keep fish away from the intake, and an inclined fish screen installed during the fall is expected to provide a permanent solution. The 1999 Sustainable Development Report will provide an update on this project. Further, unless the station's energy is

essential to "keep the lights on" — that is, meet firm power commitments—we are also prepared to suspend the station's operations during periods when abnormally high numbers of fish are being trapped.)

Manitoba Hydro's other thermal generating station in Brandon is equipped with a water cooling tower. The cooling tower eliminates the need to constantly draw water from the river when the plant is operating. But adding a cooling tower at Selkirk would be an expensive project for a generating station which is not licensed to operate beyond 2005.

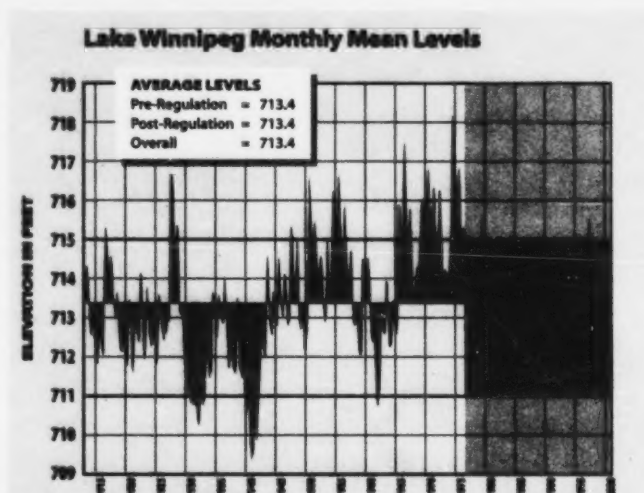
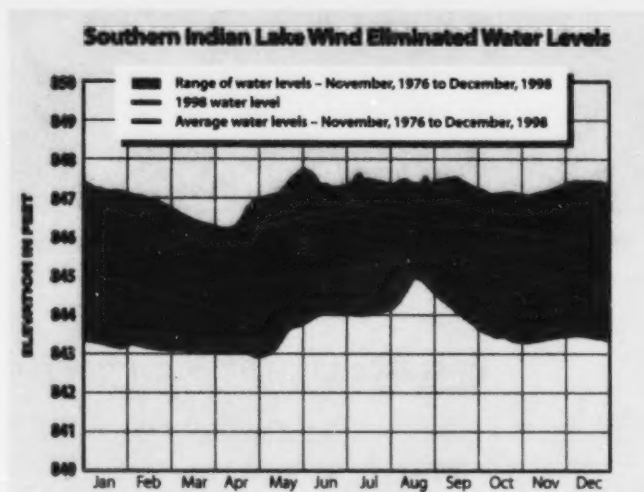
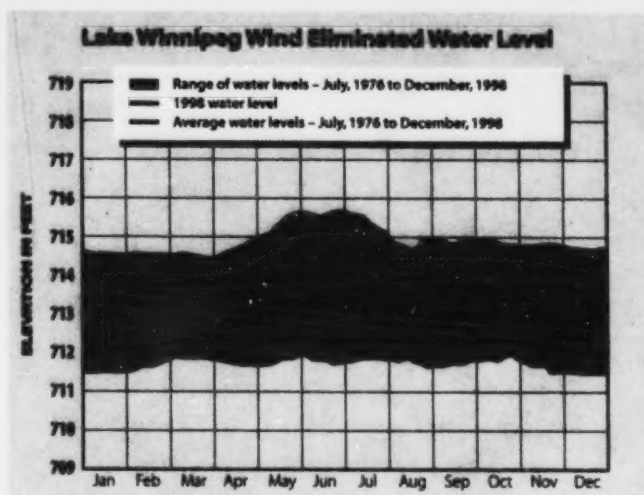
Lakes managed within regulated ranges

Lake Winnipeg and Southern Indian Lake are two of the largest reservoirs on the Manitoba Hydro system, providing water for our largest generating stations on the Nelson River. When the Lake Winnipeg wind-eliminated level is between 711 and 715 feet above sea level (a.s.l.) Manitoba Hydro regulates the outflows for power production purposes. When the lake level rises above 715 a.s.l., outflow is increased to maximum to provide flood relief on Lake Winnipeg. At Southern Indian Lake in northern Manitoba, flows are regulated for power production purposes at Notigi on the Rat River and Missi on the Churchill River when the lake's wind-eliminated level is between 843 and 847.5 feet a.s.l.

Water conditions on these lakes in early 1998 were still being influenced by record 1997 floods, but both lakes were within their power production ranges at the beginning of 1998. As the year progressed the level of Lake Winnipeg rose through the spring and early summer, peaking in lake July. Water levels declined through the fall and winter, reaching below average levels by the end of the year.

During this period the Winnipeg River, a major Lake Winnipeg tributary, experienced near-record low flows. Manitoba Hydro operates four smaller generating stations on the Winnipeg River.

Southern Indian Lake experienced average inflows during the first half of the year. This contributed to above average water levels on the lake until mid-July. During the remainder of the year, the lake experienced a normal decline in level.



coldroom laboratory at the University of Manitoba, where the researchers can watch as the anchor ice "grows" under a variety of water conditions. In this way, they are able to get a better understanding the critical elements of how anchor ice is formed and improve system operations.

Researchers are studying tree rings to get a better understanding of extreme drought conditions over the past 200-300 years in the Nelson-Churchill River basin.

The research will contribute to planning future generation options and operating the Corporation's reservoirs, and the results will also be available for other researchers interested in topics such as climate change.

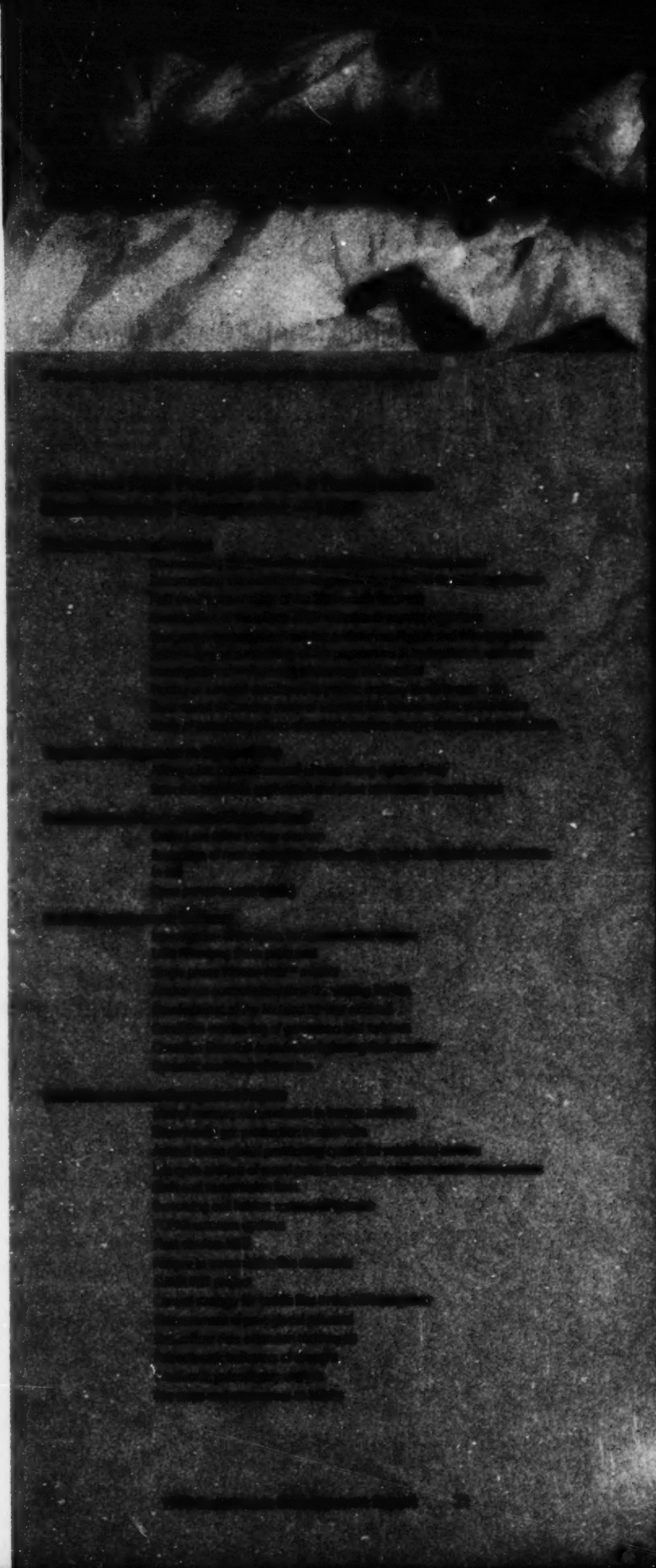
Researchers are looking into the potential of using heat from the grey or wastewater in small buildings to pre-heat water entering water heating tanks.

Benefits include saving energy, reducing demand for electricity, reducing the cost of heating domestic hot water, increasing the amount of hot water available from water heaters, and reducing the rapid drop-off in hot water when the tank is low.

Twenty greywater heat recovery systems have been installed in homes and other small buildings as part of a one-year pilot project. It was prompted by a preliminary analysis, commissioned by Manitoba Hydro and Natural Resources Canada, which indicated an energy-efficient electric hot water tank could, in many cases, provide hot water at the same operating cost as a natural gas water heater at current utility rates.

Greywater heat recovery systems typically consist of some type of heat exchanger installed in the building's plumbing drain system. The exchanger transfers heat from the greywater into the incoming cold water before it enters the water heater. Normally, the energy in greywater is lost down the drain.

It is anticipated that 20-40% of the domestic hot water load can be supplied by a well-designed greywater heat recovery system.





coldroom laboratory at the University of Manitoba, where the researchers can watch as the anchor ice grows under a variety of water conditions. In this way, they are able to get a better understanding the critical elements of how anchor ice is formed and improve system operations.

Researchers are studying tree rings to get a better understanding of extreme drought conditions over the past 200-300 years in the Nelson-Churchill River basin.

The research will contribute to planning future generation options and operating the Corporation's reservoirs, and the results will also be available for other researchers interested in topics such as climate change.

Researchers are looking into the potential of using heat from the grey or wastewater in small buildings to pre-heat water entering water heating tanks.

Benefits include saving energy, reducing demand for electricity, reducing the cost of heating domestic hot water, increasing the amount of hot water available from water heaters, and reducing the rapid drop-off in hot water when the tank is low.

Twenty grey water heat recovery systems have been installed in homes and other small buildings as part of a one-year pilot project. It was prompted by a preliminary analysis commissioned by Manitoba Hydro and Natural Resources Canada, which indicated an energy-efficient electric hot water tank could, in many cases, provide hot water at the same operating cost as a natural gas water heater at current utility rates.

Greywater heat recovery systems typically consist of some type of heat exchanger installed in the buildings plumbing drain system. The exchanger transfers heat from the greywater into the incoming cold water before it enters the water heater. Normally, the energy in greywater is lost down the drain.

It is anticipated that 20-40% of the domestic hot water load can be supplied by a well-designed greywater heat recovery system.



Manitoba Hydro supports research on lake sturgeon, one of this province's heritage fish species

Selected R&D Projects with a Sustainable Development Component — 1998

Fisheries/Aquatic Environment

- Documenting the production of mercury in flooded ecosystems
- Documenting the production of greenhouse gases in flooded ecosystems
- Post development audit of the Shellmouth Reservoir
- Investigation of the effects of UV radiation of aquatic organisms
- Sturgeon populations and habitat preferences, Pigeon and Winnipeg Rivers
- System dynamics modeling of fish populations in hydroelectric reservoirs
- Investigation of walleye egg physiology and survival
- Testing of a model developed to predict mercury levels in reservoirs
- Burst speed swimming study of selected fish species native to Manitoba
- Study of cumulative effects of multiple projects along a river on fish populations

Vegetation Management on Rights-of-Way

- Allelopathic (natural) control of trees along rights-of-way
- Selective herbicide application and plant community development

Rehabilitation of Contaminated/Disturbed lands

- Cedar Lake fallen timber cleanup
- Evaluation of methodologies for extracting diesel fuel derived contaminants in soil
- Cone penetrometer testing

Electricity and Resource Efficiency

- Investigation of compact transmission line designs
- Lake Winnipeg shore processes
- Single phase Written-Pole™ motors
- Anchor ice control-Limestone Generating Station
- Development of the McLeod harvest method
- Condition monitoring of generators and turbines
- Canadian Electrical Association lightning flash counter
- Dynamic modeling of river ice

Other Environmental Management Projects

- Methyl mercury accumulation in insects and birds
- Greenhouse gas production in reservoirs
- Animal borne global positioning system for woodland caribou
- Life cycle analysis of wood poles to evaluate environmental consequences
- Birds and transmission lines
- Burrowing owl habitat sustainability index
- POPAN software updates
- Fleet services R&D
- Fatigue in transmission line structures
- SUNBURST project
- Control strategy for caddis flies in the Winnipeg River
- Measurement of post-glacial rebound
- Streamflow data extension techniques
- Paleoclimatic indicators of drought
- Diachronic paleodietary analysis
- Fire stops and alternatives to halons

INDUSTRIAL POWER SMART SERVICES EVOLVE

The delivery of Power Smart® services to commercial and industrial customers has gradually evolved since the program was introduced roughly 10 years ago.

Basic services were offered a decade ago when the Power Smart program was considered as only an energy conservation tool. Services were generally limited to a plant walk-through that identified improvement opportunities. These "audits" were valued at more than \$500 each but offered free-of-charge. Financial incentives were provided for consulting engineers to complete feasibility studies, and customers could receive financial incentives to assist them in installing energy efficient equipment and systems.

As relationships with customers grew and staff skills expanded, the original Power Smart services were enhanced with a wider range of additional services charged at competitive rates. Services included working with the customer to develop concepts to improve systems or processes that guarantee energy savings while

providing solutions related to product quality, facility reliability, productivity, and other operational issues.

After a facility audit is completed, customers now receive a comprehensive system improvement plan with options and costs, identifying projects with energy and operational savings that pay for the cost of improvements over a period of time. After a customer commits to proceed with selected projects, Manitoba Hydro will work with trades to provide a complete design-and-build package, or we will suggest consultants and contractors to provide the service.

In the last five years alone, customers have saved more than \$100 million on their electricity bills while achieving additional benefits, from process optimization, improved working conditions, and product quality improvements to increased productivity, lower maintenance costs, and reduced waste material.

Expertise needed to make these benefits a reality has also broadened, with solutions involving refrigeration, membranes, compressed air, industrial heating, lighting, power quality, power factor correction, and co-generation.

Residential customers appreciate Power Smart Know How

The Know How campaign, which ran from 1996 to 1998, was a year-round program providing customers with seasonal-specific information they could apply to make informed choices on how they use electricity and get the most out of their energy dollars. It was developed in response to customer focus groups who stressed the need for information on where they could get Power Smart products when they needed those products throughout the year, rather than the original once-a-year approach that customers felt gave them too much information all at once.

The Know How campaign dealt with six major topics:

- Outdoor timers and power saver cords for cars;
- Energy efficient showerheads;
- Energy saving measures such as home insulation, air sealing, weather-stripping and caulking;
- How to reduce the energy use of appliances in kitchen and laundry;
- Energy wise choices for buying and using air conditioners; and
- Saving with security lighting motion sensors.

The campaign was supported by bill stuffers to Hydro customers, radio commercials, newspaper advertisements,

and a Power Smart newsletter. Letters were also sent to retailers to encourage their support of the campaign, supplemented by point-of-sale posters and counter cards to help promote products.

Surveys showed that the campaign built awareness of Power Smart. It helped customers improve their comfort and lower their electricity bills.

They appreciated understanding the cost of operating electrical products and being able to save through Power Smart know-how.

[Editor's Update: As a follow-up to the Know How campaign, a multi-media advertising campaign was launched in 1999 to increase the awareness of other benefits of Power Smart in addition to its primary message of energy efficiency. While maintaining awareness of Power Smart as an energy efficiency program, the new campaign also educates consumers on the positive effects that Power Smart has on keeping rates low and improving system reliability. The primary audience for the campaign is residential customers, but commercial and industrial customers should also benefit from the mass media campaign.]

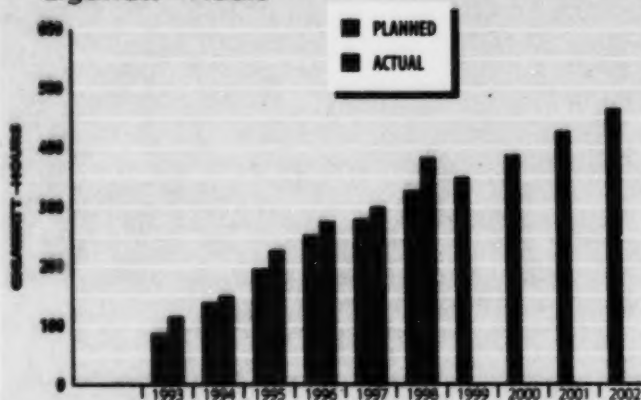
Improvements in supply efficiencies

Manitoba Hydro is regularly upgrading and refurbishing its existing system, resulting in improvements in our supply efficiencies.

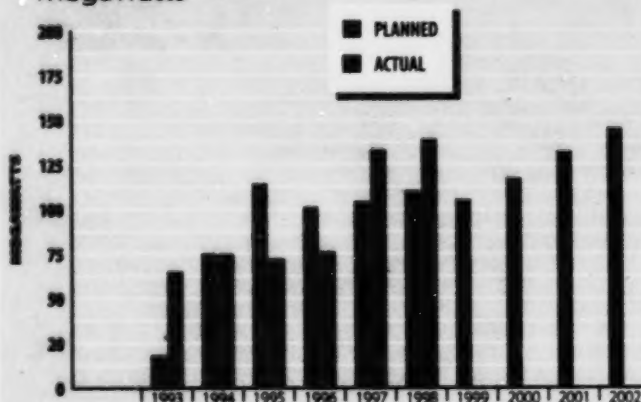
Since 1990, for example, supply efficiency improvements in our hydraulic generating stations have amounted to 43 megawatts of capacity and 106 gigawatts in average annual energy. In most cases, these are the result of improvements to the turbine runners (the propellers of generating units that are turned by water) and the copper wire windings in the generators. In 1998, one generating unit which had been re-runnered in 1995 came back into service after being fitted with new bushings. Since being re-runnered, this generator has an extra 9 megawatts of capacity and produces an extra 5 gigawatt hours of average annual energy.

Significant improvements are targeted for 1999 and 2000, with two re-runnered generating units and a major 230 kilovolt transmission line from Dorsey-Neepawa-Brandon coming into service. These three projects are estimated to produce 25 megawatts of improvements.

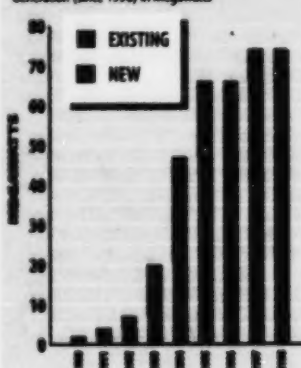
**Demand Side Cumulative Savings Targeted & Achieved
Gigawatt - Hours**



**Demand Side Cumulative Savings Targeted & Achieved
Megawatts**



**Cumulative Supply Efficiency Improvements
Generation (since 1990) in Megawatts**



Manitoba Hydro encourages energy conservation with our electricity customers and within our own operations. Demand-side energy programs marketed through our Power Smart Program reduce the amount of energy required by our customers. Our own supply-side programs result in greater internal efficiencies by increasing output from our generating system and reducing energy losses from our transmission and distribution systems.

Years indicated in the demand-side charts refer to fiscal year ends. For example, 1993 refers to fiscal year 1993/94.

Current and Planned Power Smart Programs-1998

Program	Goal	MW Savings*		GW.h Savings*		Status
		Actual to end of 1998/99	Planned 1999/00-2011/12	Actual to end of 1998/99	Planned 1999/00-2011/12	
Residential						
Existing Homes	Encourage home owners to retrofit with the maximum cost-effective levels of insulation in their existing homes.	0.00	6.726	0.00	22.161	design phase
New Homes Insulation	Encourage new home buyers and builders to incorporate the maximum cost-effective levels of insulation in their new homes.	0.00	0.729	0.00	4.024	design phase
Appliance Program	Through a national information dissemination program, encourage residential customers to buy energy efficient models when replacing their appliances.	—	—	—	—	consumer info
"No Worry Plan" Hot Water Tank Program"	As a customer service and Power Smart program, encourage residential customers with electric water heaters to purchase, finance, or lease the highest available energy efficient heater when replacing their electric heaters or installing new ones.	0.05	0.25	0.52	2.88	launched 1997
Water Saver Component Program	Encourage customers of the "No Worry Plan" Hot Water Tank to install energy saving devices (faucet aerators, heat traps, energy-efficient shower heads, pipe wrap) as part of a bonus package when installing their new water tanks.	0.02	0.21	0.24	1.39	launched 1997
Power Saver Cord	Encourage the installation of temperature control relays to control block heaters on new vehicles.	—	—	—	—	consumer info
Heat Recovery Ventilation	Transform the market in heating and ventilation of homes to include heat recovery ventilators.	—	—	—	—	design phase
Commercial						
Commercial Lighting	Encourage customers to install cost-effective energy efficient lighting systems and involve lighting distributors, installers, contractors, and manufacturers in helping their customers save electricity.	13.38	51.70	76.86 2	24.36	launched April 1992
Commercial Custom	Encourage commercial customers who are renovating or building new facilities to incorporate custom energy efficient measures such as ground source heat pumps and direct digital controllers.	1.92	28.37	4.12	60.56	launched December 1995
Air Barrier Systems	Encourage customers who are renovating or building new facilities to incorporate effective air barrier systems that will reduce operating costs and alleviate potential moisture problems.	0.13	0.06	0.32	0.16	launched December 1995
Commercial Windows	Encourage customers who are renovating or building new facilities to incorporate energy efficient windows that are cost-effective and reduce operating costs.	0.26	0.26	0.58	0.68	launched December 1995
Air-conditioners	Where these types of systems are used, encourage commercial and industrial customers to select energy efficient equipment for new construction or when replacing existing equipment.	0.00	0.00	0.03	2.07	launched December 1995
Parking Lot Controllers	Encourage customers to install Parking Lot Control Systems in new and existing installations.	0.00	0.00	3.83 2	.38	launched December 1995
Internal Retrofit	Achieve energy efficiency at Manitoba Hydro through such measures as: retrofitting buildings to energy efficient Power Smart levels, converting lighting in parking lots to high pressure sodium, and cycling of power in parking lots.	1.07	1.98	5.32	11.46	launched July 1995
Agricultural Heat Pads	Encourage swine farrowing operations to use energy efficient heat pads rather than heat lamps for creep heating to reduce demand and energy consumption.	0.34	2.68	3.49 2	7.54	launched April 1998
Industrial						
Performance Optimization of Motor Systems	Encourage commercial and industrial customers to achieve energy savings by optimizing fans, pumps, compressors, and other motor systems. Measures include speed controls, equipment improvements, and system modifications that reduce flow resistance. Energy savings of up to 50% can be achieved.	6.74	8.00	50.11	50.92.92	launched June 1993
High Efficiency Motors	Encourage vendors to promote and stock high-efficiency motors, and influence customers to install high-efficiency motors.	4.17	energy efficiency legislation	23.68	energy efficiency legislation	launched September 1991
Industrial Retrofit	Analyze customer electrical equipment and energy systems and provide solutions for energy savings, performance enhancements, and process and production improvements.	5.11	8.94	58.74	56.94	pilot program
Quality Motor Repair	Encourage customers to request quality motor repairs.	0.00	1.87	0.00	13.20	pre-design/market research
Time of Use Rates Option	Encourage general service large customers to reduce on-peak demand by permanently shifting load to off-peak periods.	0.00	22.00	0.00	0.00	being designed
Curtailable Rates (options A and AE)	Encourage large industrial customers to allow Manitoba Hydro to curtail electricity supplied to them for up to 4 hours on 5-minutes' notice (option A) or up to 10 days on 48-hours' notice (option AE) by offering credits on their monthly bills.	50.36	50.60	0.00	0.00	launched December 1998

*To facilitate comparison with other data in this section, the original data in this table, which represented "at meter" savings, was translated into "at generation" savings using the following formula:
at generation savings = 1.14 x at metre savings.

Efficiency of generation, transmission and distribution system

The Canadian Electricity Association considers both station service requirements (energy required to operate a generating station) and line losses (energy lost during the transfer of electricity through transmission and distribution power lines) in measuring the internal energy efficiency of electricity utilities.

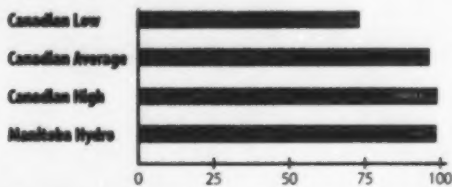
The CEA also measures how efficiently member utilities' thermal generating stations convert fossil fuels, such as coal and gas, into electricity.

Efficiency of generating stations may be adversely affected by their operation functions; that is, if they are operated for peaking (alternating operations in accordance with daily, weekly or seasonal requirements for energy), emergency and stand-by purposes.

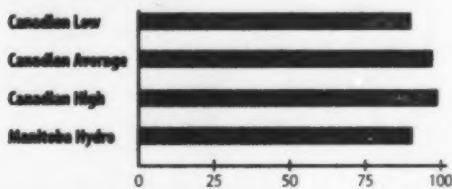
Utilities with larger, longer transmission systems, such as Manitoba Hydro's system, generally have lower internal efficiencies, as energy is lost due to electrical resistance. (On our two major north-south transmission lines, we improve efficiencies by converting to direct current.)

Internal Energy Efficiency

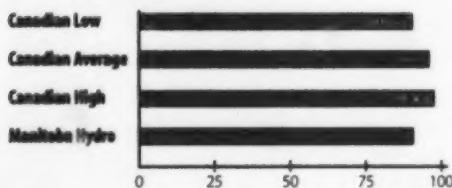
Generation 1998



Transmission 1998

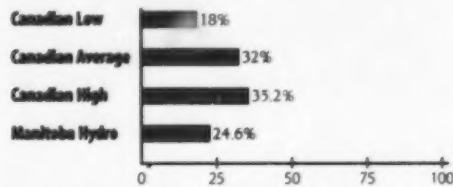


Distribution 1998

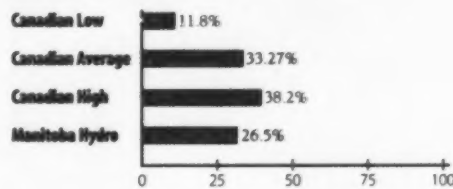


Energy Conversion Efficiency of Fossil Fuel Generation

Generation 1997



Generation 1998



Research to improve our environment and operations

Manitoba Hydro conducts many research projects to improve our operations and those of our customers. We also collaborate with many other researchers. The following are three examples of research projects associated with sustainable development; examples of other projects are listed in the accompanying table:

The search continued in 1998 for ways to reduce a major problem caused by ice accumulations on the Nelson River downstream of the Limestone Generating Station.

In winter, "anchor" ice gradually builds up on a natural rock shelf in a shallow section of the river at Sundance Rapids, about 3 kilometres downstream from the station.

The ice constriction causes a backwater effect which ultimately reduces the amount of energy generated by the plant. Over the winter, when the demand for energy is highest in Manitoba, the loss of energy is roughly 50 gigawatt hours and can result in lost revenues of up to \$1.5 million.

In 1998 a set of mini-rapids was added to a rotating flume used to model river flows. The flume is set up in a



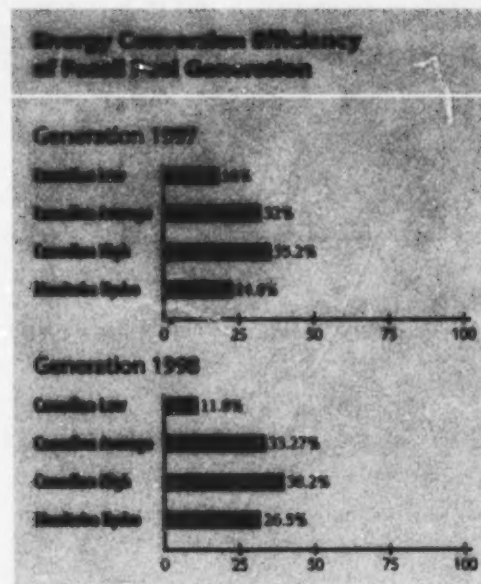
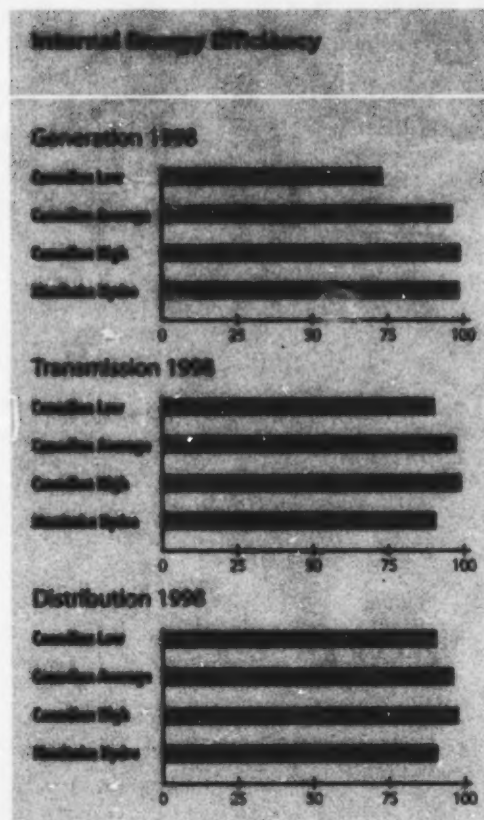
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Utilities with larger, longer transmission systems, such as Manitoba Hydro's system, generally have lower internal efficiencies, as energy is lost due to electrical resistance. (On our two major north-south transmission lines, we improve efficiencies by converting to direct current.)





Varsity volleyball teams compete at the Investors Group Athletic Centre with its specially designed Power Smart lighting plan

Power Smart designs special plan to light up gym

The new Investors Group Athletic Centre — the 1999 Pan Am Games venue for volleyball, basketball, and rhythmic gymnastics at the University of Manitoba — boasts one of the most advanced direct gymnasium lighting systems in Canada.

Some 66 lights were positioned and aimed in an orchestration of illumination that meets the needs of world-class athletes, as well as international broadcast standards for television coverage of events.

The project drew on lighting design expertise at Manitoba Hydro and the Power Smart Lighting and

Commercial Construction Programs, which help offset the extra capital cost sometimes associated with constructing or retrofitting commercial buildings to energy efficient levels.

Hydro's work ensured lighting was flexible enough to meet the needs of various events and levels of competition.

The additional cost of \$55 000 for the lighting upgrade is expected to pay for itself in about two years by avoiding the costs of renting auxiliary lighting needed to meet broadcast standards, up to \$6 000 for each event. The lights put the finishing touches on a world-class facility and add to the legacy of the 1999 Pan Am Games.

Power Smart projects create savings for customers

A heat pump is keeping tenants of Park Manor comfortable in their 12-unit life-lease housing project in Lac du Bonnet.

The ground source heat pump system keeps their suites warm in winter and cool in summer. The heat pump system offers the comfort and convenience of forced air heating and air-conditioning, but with some additional benefits.

It is more than twice as efficient as baseboard heating, for major energy savings that help keep utility costs down. Even with a rebate available from Manitoba Hydro's Commercial Construction program, the heat pump system cost an additional \$28 500 compared to a conventional electric baseboard system. But it will pay for itself in less than five years, with annual savings of about \$6 000 a year in heating and cooling costs for the building. The system also avoids the noise, shorter lifespan, uneven cooling, and additional cost of through-the-wall air conditioners that would otherwise be the responsibility of individual tenants.

Other energy efficient measures designed into the building under the Commercial Construction Program are triple glazed windows, which have virtually eliminated condensation problems year round, and a heat recovery ventilator. The heat recovery ventilator draws warm, stale air out of each suite and uses it to warm cold fresh air from outdoors. The result is a continuous supply of fresh, healthy air throughout the building.

In summer, a heat pump works like an air conditioner. It removes heat from the indoors and transfers it to the outdoors through coils on the back. In winter, it works in reverse, taking heat from the outdoors and transferring it to warm the indoors.

Heat pumps are up to three times as efficient as baseboard heating. Heat pumps simply transfer heat from one place to another, rather than generating the heat themselves.

Manitoba Hydro customers can realize substantial energy and financial savings by practising energy conservation. The following are three of many success stories:

In 1998 Palliser Furniture sought Power Smart's expertise on a compressed air system to keep humidity in its new wood parts plant at the proper level.

Maintaining relative humidity at 45% in the plant is critical. Without adequate humidity, lumber cracks, splits, shrinks, and warps. Parts have to be scrapped, and more parts made to replace them, reducing overall manufacturing capacity.

Instead of a standard compressed air system, a new water-pressure system was recommended. It forces water through nozzles so fine it comes out at the consistency of fog to create humidity. It also needs only 7.5 hp of power, or about 95% less than a compressed air system.

The new water pump system has supplied humidity in the plant for more than year. Every hour it pumps up to 6 kg of water through a network of stainless steel pipes mounted just below the plant ceiling. The pipes feed 400 nozzles that release "fog" to maintain humidity throughout the plant.

Along with these improvements to the manufacturing process, the system saves Palliser \$30 000 a year on its electricity bills.

In 1998, Canadian National Railways completed work on two Power Smart projects that have slashed its annual electricity bills by \$100 000. Savings were achieved with a new compressed air system and power factor correction project, both at Symington Yard.

The old compressed air system consisted of eight compressors, totalling 750 hp, that fed a network of buried metal piping designed to supply "filling" stations for pressurizing air-brakes on trains throughout the yard. A system audit revealed that the buried metal piping had developed leaks, and as a result some compressors were running constantly. New plastic piping was installed to replace the leaky steel pipes. A single 100 hp compressor now supplies the entire yard, feeding a new 10 000 gallon air storage tank that can ride out any surge in demand to keep plenty of air on hand for charging the trains.

The new compressed air system saves CN Railways \$55 000 a year, or 70% of their annual electricity use for the system. These significant savings mean that the cost of constructing the new system will be paid back in just over 2 years.

Work on the compressed air system was complemented by installation of power factor correction circuitry that makes electricity at the yard work more efficiently for CN.

An electrical audit of the yard showed that its power factor sometimes sank as low as 0.8, the equivalent of getting the use of only 8 litres of 10 litres of gas you bought for your car.

Power Smart's power factor experts recommended a yard-wide power factor correction system that saves CN \$45 000 a year. The system has two settings, one for winter and one for summer, for maximum year-round efficiency.

STRONG MARKETS CONTRIBUTE TO FINANCIAL PERFORMANCE

Once again in 1998 Manitoba Hydro achieved record sales and revenues while continuing to provide Manitoba customers with electricity rates among the lowest in North America.

Energy generation dropped to 31,798 gigawatt hours, the second highest annual output in our history but down slightly from the 1997 record (see accompanying graphs). However, strong markets resulted in an increase in total revenue, to a record \$1.052 billion.

The continued strong financial performance reduced our debt-equity ratio to 85:15 and kept us on target for our 75:25 objective by 2006.

With recent regulatory changes in the American electricity industry, we were able to do business with energy companies and marketers as far away as Alabama, Texas, Colorado and Oregon. But our major export customers continue to be in the states of Minnesota and North Dakota and the neighbouring provinces of Ontario and Saskatchewan.

Revenue from the export sales enables Manitoba Hydro to offer electricity rates that are among the lowest anywhere (see accompanying graphs).

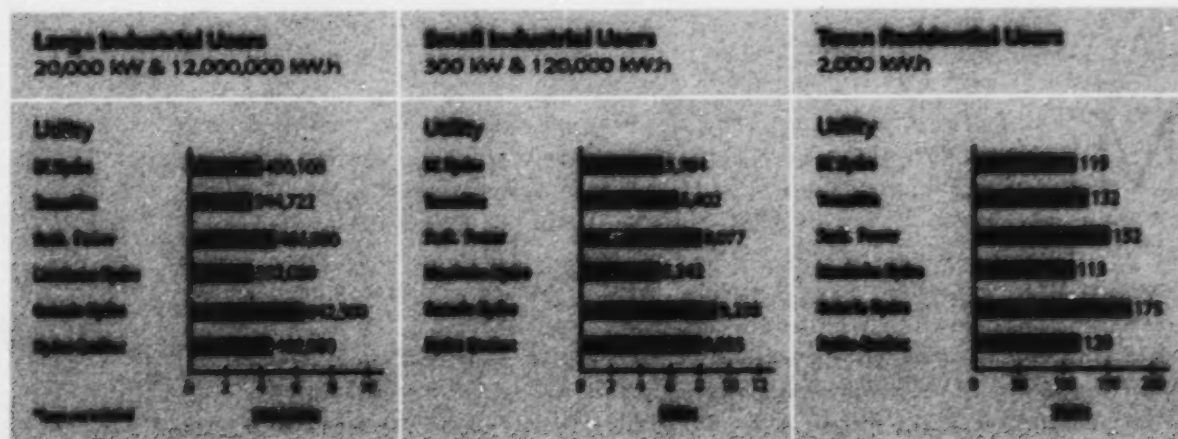
To take advantage of future export opportunities, Manitoba Hydro is moving forward with its engineering and environmental planning. By 2001 we should decide

whether to apply for environmental approval to construct and operate any of three hydroelectric projects currently under consideration. With the time allowed for current studies and environmental reviews, the earliest construction will begin, is 2003. Depending upon the project, four to five years will be needed for construction.

On the other hand, if no additional generating capacity is developed to capitalize on the export market, a new generation station to meet the needs of our Manitoba customers will not be required until about 2014. Our provincial electricity load is anticipated to grow an average of 1.2% per year over the next 10 years.

Whether we build to fill the electrical requirements of Manitobans or to market to export customers, Manitoba Hydro's favoured site for the next hydroelectric generating station is at Wuskwatim Lake in the Nisichawayasihk Cree Nation's resource management area. Another option is Gull Rapids in the Split Lake Cree Nation's resource management area. As well, a relatively small generating station could be added to the Notigi Control Structure, also in the Nisichawayasihk Cree Nation's resource management area. While Manitoba Hydro continues with its engineering and environmental planning, the respective First Nations are involved in activities which will assist

Comparison of Monthly Electricity Bills 1998



them in determining if they will support future development in their areas.

Manitoba Hydro is also studying thermal generating options. We plan to continue operating the Brandon coal-fired thermal generating station until 2019, if our environmental licence due to expire in 2006 can be renewed. A \$75 million environmental and efficiency upgrade at this station was completed in 1996.

Our second coal-fired thermal generating station, at Selkirk, will require extensive upgrades if we are to apply for an extension to its environmental licence beyond 2005. While our plans at present do not include the operation of this plant beyond its current environmental licence, options for the station's future will be considered in our next annual power resource plan.

Manitoba Hydro has also given serious consideration to adding gas-fired thermal generating capacity to its system. Gas is favoured over coal for new thermal generating stations because of its lower air emissions and the competitive cost of gas as a fuel.

Gas generating stations can be planned, designed and constructed in less than half the time required for hydroelectric generating stations, a distinct advantage in today's competitive electricity market. Manitoba Hydro anticipates adding gas combustion turbines to our generating mix over the next 20 years. The gas turbines will provide greater flexibility and reliability for our existing system, with its strong emphasis on low-cost but weather-dependent hydroelectric generating stations.

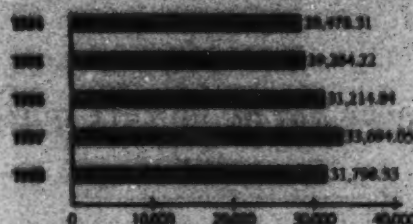
[Editor's Update: At the time of publication, Manitoba Hydro had announced plans for a new gas combustion turbine in Brandon with in-service in 2002.]

Each technology poses its own environmental issues. Most significantly, gas turbines produce air emissions, including greenhouse gases, although these are substantially less than coal-fuelled turbines; and hydroelectric developments must manage aquatic related issues and the social-economic concerns of Aboriginal and other affected communities.

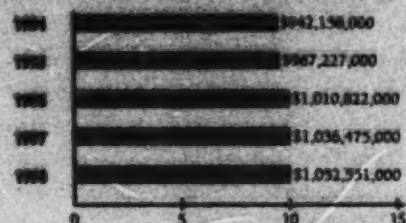
Other technologies, such as wind turbines, continue to improve but are not yet economically competitive with our hydroelectric resources or gas combustion turbines. Their energy is also less reliable and to a substantial degree must be backed up by thermal and hydroelectric generators.

System Total

Generation GWh

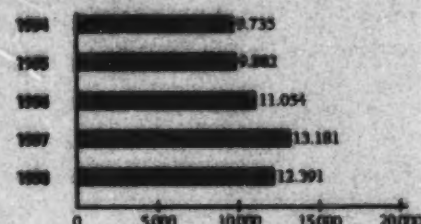


Revenue from Energy Sales (millions)

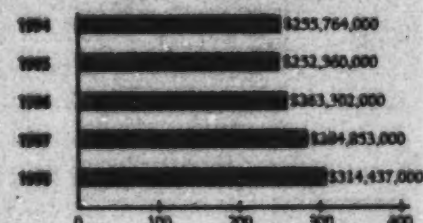


Export Only

Export Sales GWh



Revenue from Export Sales (millions)



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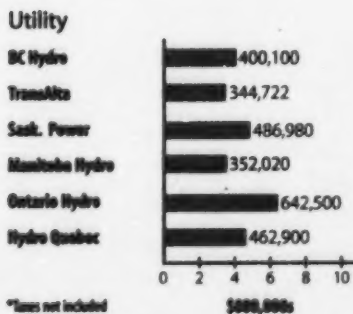
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On the other hand, if no additional generating capacity is developed to capitalize on the export market, a new generation station to meet the needs of our Manitoba customers will not be required until about 2014. Our provincial electricity load is anticipated to grow an average of 1.2% per year over the next 10 years.

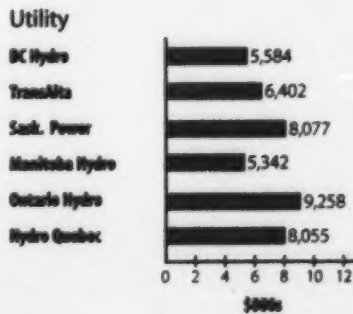
Whether we build to fill the electrical requirements of Manitobans or to market to export customers, Manitoba Hydro's favoured site for the next hydroelectric generating station is at Wuskwatim Lake in the Nisichawayasihk Cree Nation's resource management area. Another option is Gull Rapids in the Split Lake Cree Nation's resource management area. As well, a relatively small generating station could be added to the Notigi Control Structure, also in the Nisichawayasihk Cree Nation's resource management area. While Manitoba Hydro continues with its engineering and environmental planning, the respective First Nations are involved in activities which will assist

Comparison of Monthly Electricity Bills 1998

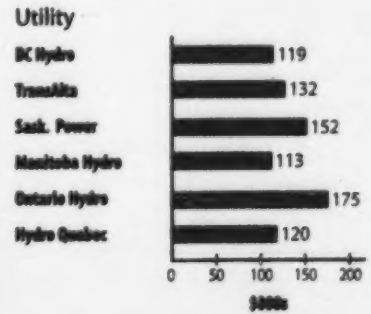
Large Industrial Users 20,000 kW & 12,000,000 kW.h



Small Industrial Users 300 kW & 120,000 kW.h



Town Residential Users 2,000 kW.h



them in determining if they will support future development in their areas.

Manitoba Hydro is also studying thermal generating options. We plan to continue operating the Brandon coal-fired thermal generating station until 2019, if our environmental licence due to expire in 2006 can be renewed. A \$75 million environmental and efficiency upgrade at this station was completed in 1996.

Our second coal-fired thermal generating station, at Selkirk, will require extensive upgrades if we are to apply for an extension to its environmental licence beyond 2005. While our plans at present do not include the operation of this plant beyond its current environmental licence, options for the station's future will be considered in our next annual power resource plan.

Manitoba Hydro has also given serious consideration to adding gas-fired thermal generating capacity to its system. Gas is favoured over coal for new thermal generating stations because of its lower air emissions and the competitive cost of gas as a fuel.

Gas generating stations can be planned, designed and constructed in less than half the time required for hydroelectric generating stations, a distinct advantage in today's competitive electricity market. Manitoba Hydro anticipates adding gas combustion turbines to our generating mix over the next 20 years. The gas turbines will provide greater flexibility and reliability for our existing system, with its strong emphasis on low-cost but weather-dependent hydroelectric generating stations.

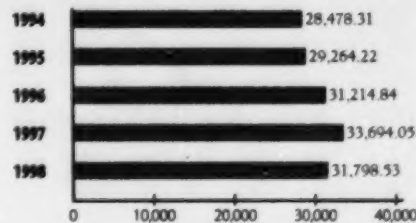
[Editor's Update: At the time of publication, Manitoba Hydro had announced plans for a new gas combustion turbine in Brandon with in-service in 2002.]

Each technology poses its own environmental issues. Most significantly, gas turbines produce air emissions, including greenhouse gases, although these are substantially less than coal-fuelled turbines; and hydroelectric developments must manage aquatic related issues and the social-economic concerns of Aboriginal and other affected communities.

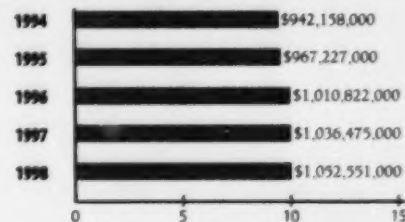
Other technologies, such as wind turbines, continue to improve but are not yet economically competitive with our hydroelectric resources or gas combustion turbines. Their energy is also less reliable and to a substantial degree must be backed up by thermal and hydroelectric generators.

System Total

Generation GWh

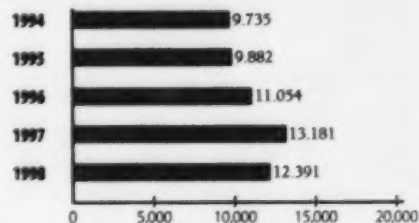


Revenue from Energy Sales (millions)

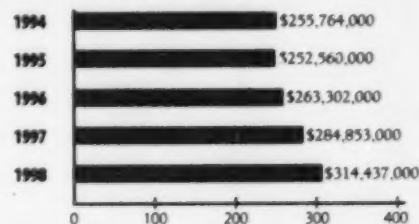


Export Only

Export Sales GWh



Revenue from Export Sales (millions)



CREE NATION INVESTS IN ITS FUTURE

The distinctive red and yellow crest of the Nisichawayasihk Cree Nation hangs over the main entrance of the Mystery Lake Hotel in Thompson. The emblem is a constant reminder of the Cree Nation's continuing efforts to provide a better future for its members.

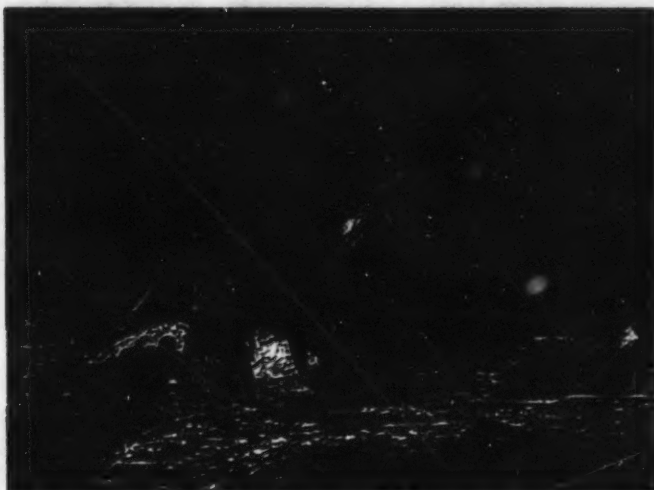
The Nisichawayasihk Cree Nation purchased the hotel in 1998, securing its financing with funds from its Comprehensive Settlement Agreement under the Northern Flood Agreement with Manitoba Hydro and the Governments of Manitoba and Canada. Under the 1996 Comprehensive Settlement Agreement, the Nisichawayasihk (formerly the Nelson House) Cree Nation received 27,700 hectares (56,000 acres) and \$62.5 million in cash and Hydro bonds. The Cree Nation controls these funds through its strictly-regulated trust and consults with community members to establish annual priorities on how best to invest and distribute the proceeds.

The following are highlights from 1998:

- Fifteen new homes were built with trust funds, doubling the number of homes made available to the community through normal federal government programs.
- One home was constructed in 1998 through a new program to encourage members to invest their own equity in their homes. Under the program, the trust provides a \$38,000 subsidy for new homes and additional funds for sewer and water services, while the homeowner secures a bank loan for the remainder of his/her financing. Four other community members had their program applications approved in 1998.
- Eighty-five homes were renovated in 1998, with most consuming all of the \$5,000 maximum allocation.
- Seventy-seven elders from the generation most affected by hydroelectric development received a \$100 monthly supplement to their pensions.
- Elders received traditional food, such as moose, fish and berries, under a country foods program operated with trust funds. Three people were employed full time, and others were hired as required, to harvest and prepare the country foods, which were also made available to other community members.
- Ten elders were hired on a permanent basis and others as needed to teach traditional skills to young people. Students made a wide variety of items, such as birch baskets, snowshoes, and bone whistles, and learned how to trap beavers and prepare furs, smoke fish, and peel logs for a cabin. Other activities included ice fishing, rabbit snaring, moose and waterfowl hunting, and setting fish nets. The young people were also taught survival skills.
- Fishermen received a 90 cent per kilogram subsidy to supplement their incomes in 1998.
- Trappers received an 80% subsidy for their production, to a maximum of \$1,000.
- Fishermen and trappers were also eligible for assistance with start-up costs and equipment purchases.
- The Pow Wow Committee constructed an harbour and promoted dance and drum events.
- Operating and maintenance funds were provided to a newly-constructed day care in 1998, so it could begin operations before receiving funding from other sources.
- A wide variety of sports, musical and dance programs were offered under the parks and recreation program, and new beach volleyball courts and baseball diamonds were constructed.
- A new police vehicle, a new snowmobile and ancillary equipment, and other equipment were purchased in 1998 to support community policing. Funds were also provided to supplement wages.
- The safety program purchased a new fire truck, modern fire fighting apparel, and the Jaws of Life. The trust also provided the equity necessary to secure a loan for a new medi-vac unit.

- Local youth furnished the Duncan Wood Memorial Hall, set aside exclusively for their use, with sofas, computers, video equipment, pool tables, a popcorn machine, confectionery, and other equipment and supplies. Nisichawayasihk youth elect their own Youth Chief and Council to represent their interests, and these young leaders are mandated to administer funds set aside for youth services.
- Churches received \$25,000 for renovations in 1998.
- Funds were provided to an initiative to develop a Cree Nation justice system.

Under the Comprehensive Implementation Agreement, Manitoba Hydro hired local resource users to provide safe ice trails, navigational aids and warning signs. We also covered 90% of the operational costs of the local arena, which in 1998 amounted to \$300,000.



Nisichawayasihk Cree members use facilities provided at Lefthook Lake to participate in traditional activities

Comprehensive settlements achieved with 4 of 5 First Nations

The Northern Flood Agreement, signed by five northern First Nations, Manitoba Hydro and the federal and provincial governments in 1977, was intended to compensate First Nation members for environmentally-related adverse effects caused by hydro-electric projects on their lands, pursuits, activities and lifestyles. There was also a developmental component for improving living conditions and employment opportunities. While many of the agreement's mitigation measures and resource compensation programs were initiated, more ambiguous aspects of the agreement were fraught with difficulties. In the late 1980s all parties to the agreement attempted to arrive at a single comprehensive agreement, rather than resolving multiple settlements on a claim-by-claim basis. This proved unattainable, but it did lead to individual First Nations negotiating their own comprehensive implementation agreements with Manitoba Hydro and the two governments. Split Lake Cree First Nation signed the first of these agreements in 1992, followed by York Factory in 1995, Nisichawayasihk (Nelson House) in 1996, and Norway House in 1997. In each instance, the comprehensive implementation agreement was ratified by a substantial majority of the First Nation members who voted.

The remaining NFA community, Pimicikamak (Cross Lake) First Nation, entered negotiations for a similar

agreement. Between 1994 to 1996 Manitoba Hydro and the governments provided Pimicikamak with over \$3 million to cover legal, consulting and community consultation costs, and the Manitoba government and Manitoba Hydro advanced an additional \$8.27 million against existing and future implementation obligations. At one point a comprehensive settlement agreement, worth \$110 million with a 16:1 land exchange (compared to a 4:1 ration under the NFA) appeared to be achievable. But Pimicikamak chose to end efforts toward a comprehensive implementation agreement and continue to operate under the original Northern Flood Agreement. Pimicikamak's relationship toward Manitoba Hydro remains strained, with each party having very different perspectives on the Northern Flood Agreement. Notwithstanding this difficulty, Manitoba Hydro is continuing to move forward to implement our obligations to Pimicikamak.

The four comprehensive implementation agreements provides significant financial resources, land in exchange for reserve land lost to hydroelectric projects (at a ratio of 16:1), and other benefits, such as resource co-management boards with the province and joint planning processes for future hydro-electric projects in their resource management areas. In total, the agreements amount to \$210 million in financial value alone.



A member of the Aboriginal Pre-placement Training Program assists with bearing maintenance at the Limestone Generating Station

Young northerners begin careers in electricity industry

A new program is providing an opportunity for young Aboriginal adults to gain experience in three Manitoba Hydro technical trades. Manitoba Hydro hopes the experience will encourage them to pursue careers with our company.

The Aboriginal Pre-Placement Training Program was initiated in 1998 with 10 candidates. Following a four week orientation, they were cycled through the three trades in our generating stations — electrical, mechanical and station operators. By the end of 1998, each candidate had completed two trades, with an early March graduation date set for their completion of the Pre-employment Placement Program. [By the time of publishing, nine candidates graduated from the program, with eight going on to apprentice with Manitoba Hydro. A new group of 10 began their pre-placement training in May, 1999.]

Candidates are chosen from northern communities in areas where Manitoba has hydroelectric operations.

Along with exposing the Aboriginal participants to Manitoba Hydro's technical trades, the program is also educating our supervisors and staff about Aboriginal issues.

Manitoba Hydro hopes the program will increase Aboriginal participation in our workforce. Prior to the program, only 6% of the 80 people employed in the mechanical, electrical and station operation trades were Aboriginal. Throughout the Corporation, Aboriginal employees represent 6.8% of the total workforce, while in northern Manitoba — where over 80% of the power is generated — Aboriginal employees represent about 20% of the workforce. Our goal is to have our staffing represent the demographics of the communities where our facilities are located.

Business with first nations

Manitoba Hydro continues to work with Aboriginal communities to ensure businesses operating in Manitoba are regularly involved in our economic activities. Negotiated contracts and joint ventures between Aboriginal and non-Aboriginal businesses continue to foster participation of Aboriginal businesses in Manitoba Hydro activities.

Aboriginal businesses were awarded 69 contracts in 1998. These contracts totalled over \$14 million. The following are the major contracts awarded over this time period:

- A Joint Venture between Wasagamack First Nation and Comstock Canada, \$3,200,000 for clearing and construction of a 138 kV transmission line from Linklater Island to Wasagamack Station as part of the North Central Project.
- St. Theresa Point First Nation, \$1,800,000 for the supply and delivery of bulk diesel fuel for the St. Theresa Point diesel generating station.

- Garden Hill First Nation, \$858,000 for the supply and delivery of bulk diesel fuel for the Garden Hill diesel generating station.
- E.T. Trucking Service of Grand Rapids, \$575,000 to supply and stockpile rip rap material for the Grand Rapids Generating Station.
- Barren Lands Construction, \$542,000 to deliver diesel fuel oil to Brochet and Lac Brochet.
- Norway House Cree Nation, \$500,000 to construct winter roads.
- Sagkeeng First Nation, \$257,000 to drill, blast and stockpile quarried rock at the Sagkeeng First Nation quarry.

Besides these contracts there were a number of others where Aboriginal businesses were involved in such activities as line clearing, equipment rental, and the supply of construction and janitorial services.

Accountable to the public

The Canadian Electricity Association posed a series of questions to assess utilities' accountability to the public. The following are the results of this questionnaire:

- 49% of Canadian utilities, including Manitoba Hydro, report achievement of environmental objectives and targets.
- 31% of Canadian utilities include a public feedback and response mechanism in their environmental reports. Manitoba Hydro did not include this mechanism in its previous report, but we have included a mail-back card with this report.
- 40% of the utilities have a procedure to document relevant information and requests on environmental performance from external parties. Manitoba Hydro does not have a formal documentation procedure at this time.

- 56% of the utilities, including Manitoba Hydro, have a procedure to respond to requests on environmental performance from external parties.
- 46% of the utilities track responses to documented, non-government external requests to ensure they are timely. Manitoba Hydro does not have a formal documentation system at this time.
- 61% of the utilities, including Manitoba Hydro, have a process in place to consider documented, non-government external inputs as part of their decision making.
- 23% of the utilities have documentation in place describing how documented, non-government external inputs are considered as part of their decision making. Manitoba Hydro does not have a formal system at this time.

Going beyond

Manitoba Hydro appreciates its community, national and international responsibilities. The following are examples from 1998 of the company and staff going beyond their normal responsibilities and duties.

- In January 1998, a severe ice storm hit central Canada, destroying much of the distribution and transmission system and leaving 3 million people without electricity. Manitoba Hydro responded to our neighbouring utilities' emergency with 146 line personnel working alongside host crews south of Ottawa and in the Montreal area for two weeks. Transformers, insulators and poles were also shipped to help Ontario Hydro and Hydro Quebec.
- Following the ice storm, a senior Manitoba Hydro manager was asked to join a team from a cross-section of electrical industry talent to help Hydro Quebec analyze its performance during the storm. Hydro Quebec was particularly interested in our ice melting and ice rolling techniques for removing ice from transmission lines. Both techniques were pioneered in Manitoba.
- After Hurricane Mitch devastated the Latin American country of Honduras, two Manitoba Hydro employees assisted with the damage assessment of the distribution and transmission system. They were impressed with the local utilities' ability to fix the local distribution system and maintain electricity service. They also informed an international aid agency of repairs which could be made to the transmission system.
- Manitoba Hydro International was active in 10 countries in 1998, assisting local utilities with their business and technical operations. Contracts for these services are funded by international aid organizations, international financial institutions, and the utilities.
- Operation Public Alert (PAL), utilizing Manitoba Hydro staff and our 1,200 radio-equipped vehicles, was launched in November. Our staff were provided with training in community watch and crime prevention to assist local law authorities in reporting possible crimes and sending aid to people in distress.
- A National Sciences and Engineering Research Council Award was presented to Manitoba Hydro in recognition of our friendship with the research council and support to the University of Manitoba, which nominated Manitoba Hydro for the award.
- The Nisichawayasihk Cree Nation honoured the Museum of Man and Nature, the Manitoba Historical Resources Branch, and Manitoba Hydro for their cooperative efforts in the recovery, analysis, replication and return of heritage artifacts to the Cree Nation. Each organization received a plaque, and individuals who made special contributions to the program were honoured with ceremonial eagle feathers.
- The new northern territory of Nunuvut is calling on Manitoba Hydro's expertise to help plan its future energy services. The feasibility of extending a transmission line from Churchill into Nunuvut is being considered, along with energy conservation programs and alternative energy sources such as wind, small hydro and hybrid diesel technologies.
- Manitoba Hydro's Environmental Partnership Fund provided a total of \$50,000 in support to 20 organizations. More than 100 not-for-profit environmental initiatives and organizations have been supported since the fund was established in 1992. Among the projects receiving support during 1998 were the Thompson Museum, Manitoba Envirothon, and the Chemawawin Adult Education program.
- The Forest Enhancement Program supported 57 community based projects that will augment Manitoba's forests. Launched in 1995, the 10-year \$3.5 million program funds tree planting, forest education, and innovative research projects. The program recognizes the loss of forest lands impacted by our power system improvements.

National body presents position on electric and magnetic fields

For some time there has been concern electric and magnetic fields from transmission lines, electrical appliances and other electrical equipment may adversely affect human health. In 1998 the Federal/Provincial Territorial Radiation Protection Committee undertook a review of this topic and issued the following position statement:

- The production of electric and magnetic fields is associated with the generation, transmission and use of electricity. People are exposed to these fields not only when they are near high voltage lines, but also at their places of work and in their homes. Such fields are produced by distribution lines, transformers, building and house wiring and by all devices that use electric power.
- Studies to investigate the health effects of these fields have been taking place around the world for more than 25 years. Such research has included laboratory studies concerning the effects on cells, tissues and animals, as well as studies on human exposure and epidemiology.
- Epidemiological studies suggest a weak association between increased risk of certain types of cancer, and exposure to magnetic and/or electric fields; however, the findings are inconsistent and inconclusive. Experiments with animals and cells show that these fields can interact with biological systems and with cellular chemistry. These interactions, however, have not been shown to lead to adverse health effects. Extensive world-wide research programs are ongoing in order to clarify whether or not there are indeed health risks.
- Research to date has not identified any biophysical mechanisms that link the initiation or promotion of cancer by power frequency field properties.
- Recommended exposure limits to prevent acute health effects have been put forward by an international committee of experts. It is extremely unlikely that members of the Canadian public would be exposed above these exposure limits. In the case of chronic exposure at ambient levels, currently available information on health and bio-effects does not provide a basis for establishing more restrictive exposure limits.
- The Federal/Provincial Territorial Radiation Protection Committee will continue to monitor the results of new studies and re-assess this position, as new information becomes available.
- In arriving at this position, the committee cited work by the Council of the American Physical Society and the International Commission on Non-Ionizing Radiation Protection.

Atmospheric Emissions

Carbon Dioxide

$$\frac{\text{Total Gross Emissions (kg)}}{\text{Total Net Utility Generation (kWh)}} = \frac{1,022,385,282}{30,837,352,508} = 0.033$$

$$\frac{\text{Total Gross Emissions (kg)}}{\text{Total Net Fossil Generation (kWh)}} = \frac{1,022,385,282}{859,784,148} = 1.189$$

Sulfur Dioxide

$$\frac{\text{Total Gross Emissions (g)}}{\text{Total Net Utility Generation (kWh)}} = \frac{3,149,958,143}{30,837,352,508} = 0.102$$

$$\frac{\text{Total Gross Emissions (g)}}{\text{Total Net Fossil Generation (kWh)}} = \frac{3,149,958,143}{859,784,148} = 3.664$$

Nitrogen Oxides

$$\frac{\text{Total Gross Emissions (g)}}{\text{Total Net Utility Generation (kWh)}} = \frac{2,454,834,989}{30,837,352,508} = 0.080$$

$$\frac{\text{Total Gross Emissions (g)}}{\text{Total Net Fossil Generation (kWh)}} = \frac{2,454,834,989}{859,784,148} = 2.855$$

Reuse of Insulating Oil

$$\frac{\text{Volume of Insulating Oil Reused (L)}}{\text{Volume of Insulating Oil Reused} + \text{Recycled} + \text{Disposed as Waste (L)}} \times 100\% = \frac{1,283,037}{1,549,370} = 82.8\%$$

Utilization of Solid Combustion By-products

$$\frac{\text{Total Ash + Residue Utilized (tonnes)}}{\text{Total Ash + Residue Produced (tonnes)}} = \frac{0}{26,097} = 0\%$$

Spills

Number of reportable spills	36
Number of non-reportable spills	48
Number of priority spills	5

Atmospheric emissions are compiled for each utility's fossil generation and for each utility's total net generation, which for Manitoba Hydro includes fossil and hydroelectric generation. In calculating carbon dioxide emissions, total tonnes of offsets (4,877,327) are subtracted from total gross emissions (115,565,932) for the industry. (Manitoba Hydro claims no carbon dioxide offsets for our system.) It has been recognized that some hydroelectric reservoirs emit greenhouse gases, but these are considered to be relatively small and no accurate method exists for calculating these emissions.

Manitoba Hydro reconditions all the insulating oil that we can re-use in our equipment. However, we do not require all of the used oil which is accumulated. The remainder is sold for energy recovery.

As noted on Page 9, environmental approval has been received to use ash from Manitoba Hydro's fossil generators for selected purposes. Therefore, better results are anticipated in the future.

Reportable spills are those spills which must be reported to regulatory officials (that is, they exceed 68 litres of insulating oil or other petroleum products, 45 parts per million of PCBs, or 10 or more kilograms of ozone depleting substances). Non-reportable spills are those which are less than these amounts, but which Manitoba Hydro tracks for our own records. In addition, the Canadian Electricity Association categorizes priority spills as those which involve petroleum products or PCB-contaminated substances in which the spill volume is greater than 500 litres, the spilled substance enters a waterbody, or the spill is reported in the media. The 5 Manitoba Hydro spills in the priority category are included among the 36 spills reported to regulatory authorities.

PCB Materials in Use and Storage

High level PCB material in service (tonnes)	578
Low level PCB material in service (tonnes)	710
High level PCB material in storage (tonnes)	15.89
Low level PCB material in storage (tonnes)	12.94

High level PCB is defined on the basis of federal regulation as any material with a PCB concentration of greater than 10,000 milligrams per kilogram. Low level PCB is material with a concentration greater than 50 milligrams per kilogram but less than 10,000 milligrams per kilogram.

Internal Energy Efficiency

Generation

$$1.0 - \left[\frac{\text{Generation Internal Energy Use (GWh)}}{\text{Generation Energy Output (GWh)}} \right] \times 100\%$$

$$1 - \left[\frac{177.0}{31,621.53} \right] \times 100 = 99.44\%$$

Transmission

$$1.0 - \left[\frac{\text{Transmission Internal Energy Use (GWh)}}{\text{Transmission Energy Output (GWh)}} \right] \times 100\%$$

$$1 - \left[\frac{2919.08}{29,742.33} \right] \times 100 = 90.19\%$$

Distribution

$$1.0 - \left[\frac{\text{Distribution Internal Energy Use (GWh)}}{\text{Distribution Energy Output (GWh)}} \right] \times 100\%$$

$$1 - \left[\frac{1519.43}{17,628.84} \right] \times 100 = 90.57\%$$

The Internal Energy Efficiency indicator includes energy required to operate a generating station and line losses (energy lost when electricity is transferred through transmission and distribution lines).

Efficiency of generating stations may be adversely affected by their operational functions; that is, if they are operated for peaking (altering operations in accordance with daily, weekly or seasonal requirements for energy), emergency and stand-by purposes.

Utilities with larger, longer transmission systems, such as Manitoba Hydro, generally have lower internal efficiencies, as energy is lost due to electrical resistance. (On its two major north-south transmission lines, Manitoba Hydro improves efficiencies by converting the electricity to direct current.)

Energy Conversion of Fossil Fuel Efficiency

$$\frac{\text{Net Energy Output (GWh)} \times 100\%}{\text{Total Energy Output}}$$

Energy Conversion of Fossil Fuel Efficiency

$$\left[\frac{844.26}{3183.02} \right] \times 100 = 26.5\%$$

Utilities more reliant on fossil generation generally report higher efficiencies of their fossil generation systems. Utilities less reliant on fossil generation, such as Manitoba Hydro, tend to operate their fossil generators for peaking, emergency and stand-by purposes, resulting in lower efficiencies. (While efficiencies may be adversely affected, total air emissions are reduced when fossil generating stations are used less often.)

Our Sustainable Development Policy and Principles

Manitoba Hydro recognizes that the economy and the environment are mutually dependent. Without a healthy environment, a healthy economy cannot be sustained. And without a healthy economy, there is less wealth to channel into the protection, maintenance, restoration, and rehabilitation of the environment.

In 1993, the Corporation adopted a sustainable development policy to link its responsibilities for supplying electricity, protecting the environment and human health, and contributing to the competitiveness of Manitoba's economy.

The policy and 13 complementary guiding principles are based on the principles and guidelines of sustainable development adopted by the Manitoba Round Table on Environment and Economy.

They represent a guiding influence for Hydro's decisions, actions, and day-to-day operations.

Sustainable Development Policy

Manitoba Hydro will apply the principles of sustainable development in all aspects of its operations to achieve environmentally sound and sustainable economic development. Through its decisions and actions to provide electrical services, the Corporation will endeavour to meet the needs of the present without compromising the ability of future generations to meet their needs.

Sustainable Development Principles

Manitoba Hydro will:

1. STEWARDSHIP OF THE ECONOMY AND THE ENVIRONMENT

Recognize its responsibility as a caretaker of the economy and the environment for the benefit of present and future generations of Manitobans.

Meet the electricity needs of present and future Manitobans in a manner that ensures the long-term integrity and productivity of our economy, our environment, our natural resources and safeguards our human health.

2. SHARED RESPONSIBILITY

Ensure that Manitoba Hydro's employees, contractors, and agents are aware of our sustainable development policies and guiding principles and encourage them to act accordingly.

Encourage the Corporation's employees to share their knowledge of the concepts and practical application of sustainable development.

3. INTEGRATION OF ENVIRONMENTAL AND ECONOMIC DECISIONS

Treat technical, economic and environmental factors on the same basis in all corporate decisions, from initial planning to construction to operations to decommissioning and disposal. To the extent practical, include environmental costs in economic and financial analysis.

4. ECONOMIC ENHANCEMENT

Enhance the productive capability and quality of Manitoba's economy and the well-being of Manitobans by providing reliable electrical services at competitive rates.

5. EFFICIENT USE OF RESOURCES

Encourage the development and application of programs and pricing mechanisms for efficient and economic use of electricity by our customers. As well, efficient and economic use of energy and materials will be encouraged throughout all our operations.

6. PREVENTION AND REMEDY

To the extent practical, anticipate and prevent adverse environmental and economic effects that may be caused by Corporate policies, programs, projects and decisions rather than reacting to and remedying such effects after they have occurred.

Purchase, where practical, environmentally sound products taking into account the lifecycle of the products.

Address adverse environmental effects of Corporate activities that cannot be prevented by:

- first, endeavouring, wherever feasible, to restore the environment to pre-development conditions or developing other beneficial uses through rehabilitation and reclamation
 - second, striving to replace the loss with substitutes that would enhance the environment and/or associated resource uses while offsetting the type of damage experienced
 - third, making monetary payments for compensable damages on a fair, equitable and timely basis.
-

7. CONSERVATION

To the extent practical, plan, design, build, operate, maintain and decommission Corporate facilities in a manner that protects essential ecological processes and biological diversity.

Give preference, where practical, to projects and operating decisions that use renewable resources or that extend the life of supplies of nonrenewable resources.

8. WASTE MINIMIZATION

Manage all wastes arising from Corporate activities by:

- first, endeavouring to eliminate or reduce the amount generated
 - second, striving to fully utilise reuse and recycling opportunities
 - third, disposing of remaining waste in an environmentally sound manner.
-

9. ACCESS TO ADEQUATE INFORMATION

Share relevant information on a timely basis with employees, interested people and governments to promote a greater understanding of Manitoba Hydro's current and planned business activities and to identify impacts associated with the Corporation's plans and operations.

10. PUBLIC PARTICIPATION

Provide opportunities for input by potentially affected and interested parties when evaluating development and program alternatives and before deciding on a final course of action.

11. UNDERSTANDING AND RESPECT

Strive to understand and respect differing social and economic views, values, traditions and aspirations when deciding upon or taking action.

Give preference to those alternatives which best fulfill Corporate objectives while minimizing infringement on the ability, rights, and interests of others to pursue their aspirations.

12. SCIENTIFIC AND TECHNOLOGICAL INNOVATION

Research, develop, test and implement technologies, practices and institutions that will make electrical supply and services more efficient, economic and environmentally sound.

13. GLOBAL RESPONSIBILITY

Recognize there are no political and jurisdictional boundaries to our environment, and that there is ecological interdependence among provinces and nations.

Consider environmental effects that occur outside of Manitoba when planning and deciding on new developments and major modifications to facilities and to methods of operation.



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